ENGINEERING LIBRARY

NOV 9 1948

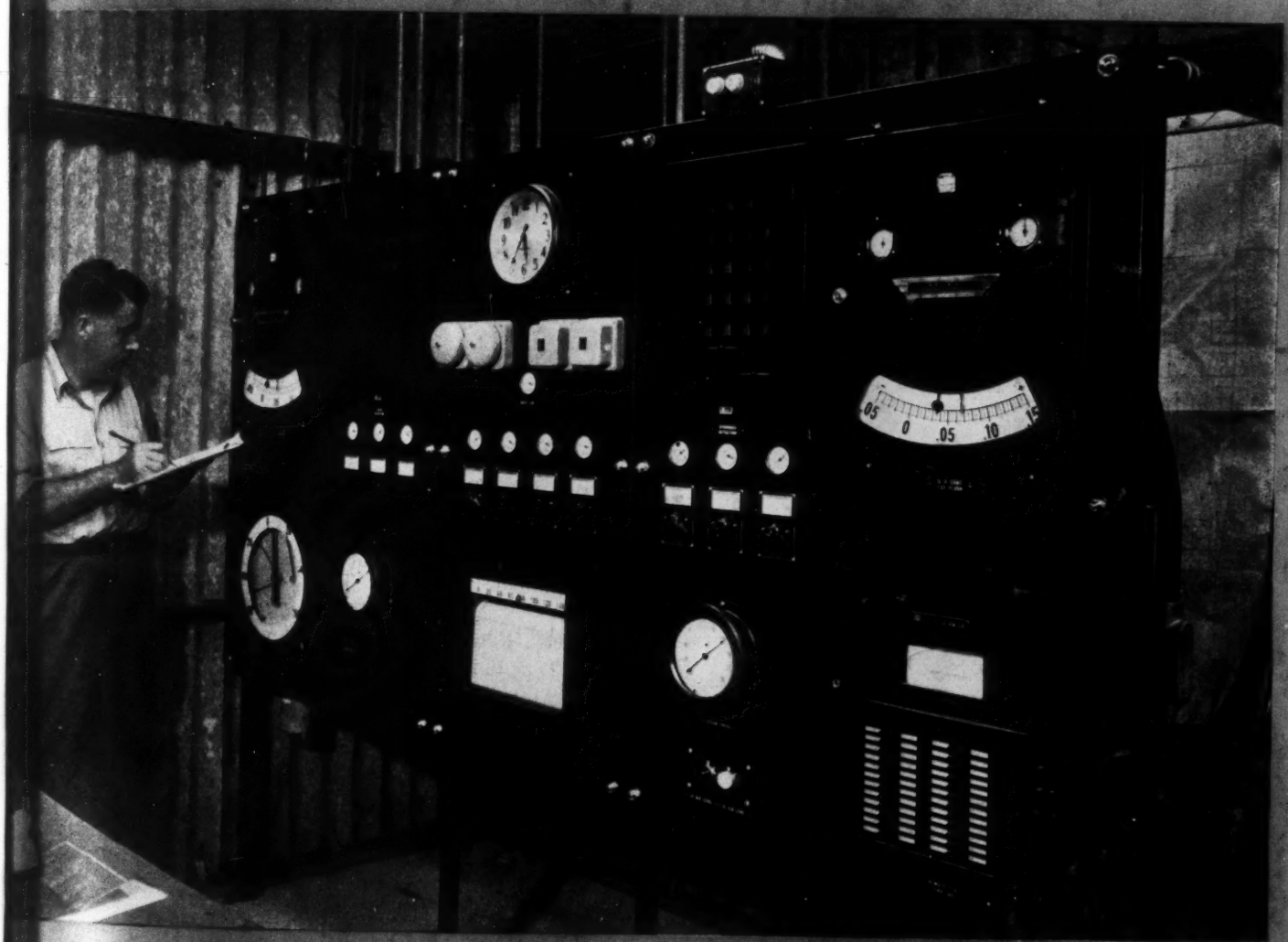
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

NOVEMBER ★ 1948

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Vol. 103—Journal Section of the American Society of Heating and Ventilating Engineers



Instrument board gives engineer full picture of plant air conditions—page 79

Piping for Steam Condensate....76

Avoiding Condensation With Cold Ducts...71

Monthly and Seasonal Degree Days.....90

Complete Contents of This Issue.....69

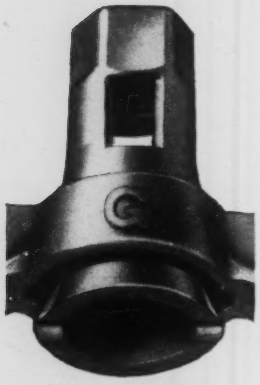
THERE'S A **GRINNELL** HANGER FOR EVERY PIPING REQUIREMENT

Hanging Pipe? Do it Right!

GRINNELL ADJUSTABLE SWIVEL PIPE RING

(Split Ring Type)

- Hinging of ring is off-center. This provides sufficient seating to hold pipe before closing ring. Wedge-type pin is loosely but inseparably cast into the hinged section for fastening after pipe is in place.
- To obtain proper adjustment, swivel shank can be turned easily by hand when the weight of the pipe is temporarily taken off the ring.
- When weight is returned, patented swivel shank locks automatically, preventing change of adjustment due to vibration. Wire retaining ring prevents separation of the swivel shank from the pipe ring or yoke . . . makes assembly a single unit.
- 12 sizes have load range of 80 lbs. for ¾" size to 1510 lbs. for 8" size. May be used in connection with practically any building attachment.



Enlarged section showing locking feature.

SAVE MONEY ON ASSEMBLY. Cut installation time, get better, stronger installations, with Grinnell Engineered Pipe Hangers.

NO SAG . . . NO WATER TRAP. Grinnell Hangers permit adjustment after pipe is installed. This makes it possible to prevent sagging pipe and water traps, and assures positive drainage for the entire system.

FOR EVERY INSTALLATION. There is a stock Grinnell Hanger for every need from simple water pipe to high pressure, high temperature steam line. Where necessary there is a hanger to compensate for thermal movement.

Don't waste time or take chances on inadequate pipe hangers and supports. All Grinnell hangers comply with piping code requirements.

GRINNELL COMPANY, INC.
Providence 1, R. I.

Branch Warehouses

Atlanta 2, Ga.	Kansas City 16, Mo.	Philadelphia 34, Pa.
Charlotte 1, N. C.	Long Beach 10, Cal.	Sacramento 14, Cal.
Chicago 9, Ill.	Los Angeles 13, Cal.	St. Louis 10, Mo.
Cleveland 14, O.	Milwaukee 3, Wis.	St. Paul, Minn.
Cranston 7, R. I.	Minneapolis 15, Minn.	San Francisco 7, Cal.
Fresno 1, Cal.	New York 17, N. Y.	Seattle 1, Wash.
Houston 1, Tex.	Oakland 7, Cal.	Spokane 15, Wash.

GRINNELL

WHENEVER **PIPING** IS INVOLVED

THE EDITOR'S PAGES

JANITOR STAFF GETS AIR CONDITIONING

One year's luxury becomes another year's necessity, it seems—and this appears to be the case with air conditioned office buildings.

Few years ago, one of the big utility companies built a completely air conditioned office building for its own occupancy, and the plan was to keep the conditioning system in operation during the business day. Instead of shutting down at 5 p.m., though, the system continues in operation far into the night. It's all for the benefit of the janitorial staff. They feel they need the benefits of air conditioning just as much as do the daytime office workers.

ADOPT ETHICAL RULES FOR ENGINEERS

Mindful of the large number of young men preparing for the engineering profession, the Engineers' Council for Professional Development has adopted Canons of Ethics for Engineers, especially to serve as a moral guide to young engineers as they progressively assume professional responsibility. The canons supplement the engineering tradition of honest public service.

Based on Christian ethics, the canons spell out the relationship of the engineer to his client, his employer, and the public. "The keystone of professional conduct," the canons state, is "integrity." The engineer must "interest himself in public welfare and be ready to apply his special knowledge to the benefit of mankind."

In his relations with the public, the engineer is directed to extend "public knowledge of engineering" and to discourage "the spreading of untrue, unfair, and exaggerated statements regarding engineering."

"He will express an opinion only when it is founded on adequate knowledge and honest conviction while he is serving as a witness before a court, commission, or other tribunal."

In his relations with clients and employers, he will "act as a faithful agent and trustee. He will disclose no information concerning the business affairs or technical processes of clients or employers without their consent."

"He will not be financially interested in the bids as or of a contractor on competitive work for which he is employed as an engineer unless he has the consent of his client and employer."

The canons direct that in his relations with his colleagues in the profession, "He will take care that credit for engineering work is given to those to whom credit is properly due. He will endeavor to provide opportunity for the professional development and advancement of engineers in his employ. He will not become associated in responsibility for work with engineers who do not conform to ethical practices."

The canons have been attractively printed on a 9½ x 14 in. card for framing and in the standard 8½ x 11 in. size for general distribution to the engineering schools and professional societies. The large size is in two colors and sells for 50c a copy. The smaller size sells for 10c, or 5c when purchased in bulk. Copies may be obtained from the Engineers' Council for Professional Development, 29 W. 39th St., New York 18.

$3 BILLION SINCE WAR FOR COMMERCIAL BUILDING

Construction of new stores, office buildings, and other commercial structures has totalled $3 billion since the war ended, according to Melvin H. Baker, chairman of the Construction Industry Information Committee.

"The volume of commercial construction during the first nine months of this year rose 64 percent over the same period in 1947," Mr. Baker said. "Only educational and religious buildings exceeded commercial construction in percentage increase during the period.

"Commercial building in the nine months amounted to $934 million, more than for the entire year of 1947," he said. "This volume is equalling the record rates of the middle 20's. Industrial construction, with a volume of more than a billion dollars in nine months, still leads all private nonresidential construction although it has leveled off since the peak postwar rates of 1946 and 1947, when manufacturers were preparing to meet an unparalleled demand for goods.

"This analysis has been made from Bureau of Labor statistics reports compiled for the first nine months of 1948.

"Telephone and telegraph construction leads all other public utility construction in gains over last year. Here we have recordbreaking expenditures totalling more than half a billion dollars in nine months of 1948, which is about 50 percent above the same period in 1947. This nine month record exceeds any whole prewar year and reflects a physical volume of construction approximating the peak levels of 1929 and 1930."

AWARD TO EMPLOYER OF HANDICAPPED

Carrier Corp., Syracuse, N. Y., was presented the American Legion award as the outstanding employer of physically handicapped persons in the state of New York at a banquet attended by Legion and company officials and civic leaders last month. The occasion was a highlight of "National Employ the Physically Handicapped Week."

In accepting the award, Cloud Wampler, president of the corporation, said that careful job analysis had made the employment of disabled veterans not only possible but advantageous to industry. Nearly 40 percent of the 3252 employees are veterans of World War II, of which 340 are classified as "disabled."

"Whatever we have done in this regard, our actions were not based on sentiment," Mr. Wampler said. "The fact is that we saw an opportunity to improve the quality of our organization and that opportunity was seized.

"Here is the real key to the problem. A man or woman—supposedly physically handicapped—is not handicapped at all if he or she is placed in a job that does not involve the disability."

THE EDITOR'S PAGES

NEW DEGREE DAY USE —FORECAST GRASSHOPPERS!

Here's a new use for the degree day values used by heating engineers, described in an item credited to the U. S. Weather Bureau and published in the bulletin of the American Meteorological Society.

In cooperation with Iowa State college, the Des Moines Weather Bureau office prepared special temperature data for Dr. Harold Gunderson, extension entomologist, which enabled him to give Iowa farmers approximately one week's warning of the extensive grasshopper hatching this spring. Daily degree day data were computed for four selected Iowa climatological stations, using a daily mean temperature of 60 F as a base and keeping running totals for each station. When the accumulated degree days approached 160, extensive hatching of grasshopper eggs occurred.

HOW TO KEEP PIPE INSULATION ON THE JOB

To provide maximum insulating value, all heat insulation requires a regular inspection and maintenance program. The steps in such a maintenance program were outlined recently by the Magnesia Insulation Manufacturers Association:

1) Periodic inspection to see that all sources of heat loss, such as new sections of piping, etc., are insulated.

2) Periodic evaluation of insulation thickness, since changes in operations or fuel costs may necessitate an increase in thickness.

3) Survey of insulation jacketing to check for adequate protection against weather, mechanical or chemical damage, etc. Scorched spots should be thoroughly investigated, since they may indicate a crack or failure in the insulation underneath, or may be a sign that the insulation is too thin.

4) Check of the insulation for loosening. If due to excessive vibration of the insulated equipment, the cause of vibration should be eliminated if possible, and the insulation re-applied and tightened. Joints should be pointed up with cement and the canvas or other jacketing replaced and securely sealed. If the vibration cannot be eliminated or reduced, another method of application of insulation may be necessary.

5) Examination for dents or cracks. Dents may be caused by mechanical abuse of insulation, such as erection of scaffolding, etc. The damaged section should be cut out and a new one of the same size and shape wired on securely. The cracks should be filled with insulating cement and the protective jacketing replaced.

6) Check after repairs of equipment due to difficulties such as waterhammer, leaks, etc., which may have caused damage to the insulation.

7) Survey of insulation after disasters such as fires, floods, etc. Lines or equipment on which insulation has been saturated by water should be brought up to full temperature slowly to prevent too rapid formation of steam between the hot surface and the insulation.

HEATERS SPED BY ARMY PLANES TO HOSPITAL

The value of intensive cooperation in solving a serious public problem was demonstrated this summer in the case of the new 160 bed emergency polio hospital at Greensboro, N. C.

Undertaking to complete the hospital in 45 days, Greensboro citizens found in mid-August that quickly installable heating equipment was needed if the September 1 completion deadline was to be met. The problem was taken over by the Greensboro office of the Trane Co. and the W. H. Sullivan Co., Inc., heating contractors.

They telephoned the La Crosse, Wis., office to rush 13,700 lb (2100 lineal feet) of wall fin heaters. Short-cutted procedures cleared the way for the factory department; customarily requiring four to six weeks, the factory workers, aware of the extreme urgency, completed the order in one—far ahead of delivery.

This situation was put up to Secretary of War Kenneth Royall, a native Carolinian, by his former special assistant, Greenboro's Judge E. Earl Rives. Secretary Royall authorized the flight to La Crosse of two "flying boxcars" from the Greenville, S. C., base. The C-82's picked up the cargo, sped back to Greensboro.

Fifty Shriners unloaded the heaters. Each of the 278 cartons was marked for the exact spot the heaters would occupy in the hospital. In minutes, workmen were installing them.

15 Years Ago

An article in the November 1933 issue, by M. M. Lawler, referred to a project that made newspaper headlines not too many weeks ago. This 1933 article, entitled Air Conditioning Saves Six Years in Making World's Largest Mirror, described the installation for providing controlled temperature and humidity in the shop where the 200 in. telescope mirror for the Mt. Palomar observatory was being ground and polished. It was estimated that, with air conditioning, the painstaking work could be done in three years instead of the nine otherwise required.

* * * * *

A story on the Century of Progress exposition in Chicago, where many people got their initial first-hand experience of air conditioning for comfort, described several of the installations on the fair grounds. The successful railroad fair, held on the same site this last summer and which is to be repeated again next year, was reminiscent of the old Century of Progress days. Since 1933, air conditioning has become standard equipment for railroad cars—like wheels!

* * * * *

An article by Sabin Crocker on the materials specifications provisions of piping standardization codes, and a report on how master control valves save heating steam at the University of Colorado, by W. E. Brockway and George S. Dobbins, were among the many other features of this 15 year old issue of HPAC.

Got Tired "Patching Up" School Heating System

Democracy in action! . . . Board of Education, Salem, N. J., is voice of community of 9,500 in school affairs. Facing camera, left to right: Smith B. Davis, Dr. A. J. Bridgman, Thomas G. Dunn, James L. Lane, Sr., Lewis F. Gayner. With back to camera, left to right: Superintendent Herbert K. England, Jr., Solicitor Joseph Narrow, Clerk Charles P. Sheppard.

In 1945 the Board of Education in Salem, N. J., decided to do something about the "patched up" heating system in their 35-year-old high school. They got tired of complaints like these:

"Had to start boiler at 2 a.m. to have school warm for 9 o'clock classes."

"The old building has to be overheated in order to get heat in the new wings."

"Windows wide open again —no positive means of temperature control."

According to the Board of Education, there were four steps in the heating modernization program.

August, 1945 . . . Property Committee asked Warren Webster & Company to survey the heating system and suggest improvements for 1946 budget.

January, 1946 . . . Webster Representative reported on survey of heating system and suggested modernization program.

June, 1946 . . . Property Committee approved Webster Heating Modernization Program. Board of Education voted unanimously to follow Committee's recommendations.

Salem High School, Salem, N. J. Built in 1912. Wings added 1927. Steam heat distribution modernized 1946 with "Controlled-by-the-Weather" Webster Moderator System. Modernization Heating Contractor—William J. Kelly, Inc., Camden, N. J.

October, 1946 . . . Installation of Webster Moderator System with "Controlled-by-the-Weather" Outdoor Thermostat completed by Contractor William J. Kelly in time for start of heating season. The existing stoker-fired coal-burning boiler plant was retained.

As part of the modernization, traps damaged beyond repair were replaced with the latest-type Webster Thermostatic Radiator Traps. Other traps were brought up-to-date with Webster Replacement Thermostats.

With the Webster Moderator System, all sections of the school heat evenly and rapidly. Heat loss from open windows is minimized by the maintenance of comfortable indoor temperatures. The heating-up time is shortened so that boilers fired at 6 a.m. have school warm for 9 o'clock classes even on coldest days.

There is a trained Webster Representative not far from your city. He is available to cooperate with your architect, engineer and contractor in serving *your* Property Committee.

Address Dept. HP-11

WARREN WEBSTER & CO.

Camden, N. J. : : Representatives In Principal Cities

In Canada, Darling Brothers, Limited, Montreal

WEBSTER MODERATOR SYSTEM OF STEAM HEATING

"Controlled by the weather"

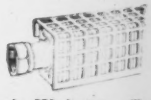
Webster Heating Equipment for School Buildings

Webster Metering Orifices, expertly sized, a vital feature of the Moderator System, balance distribution and make possible central control with continuous heating.

Webster Outdoor Thermostat Control automatically provides the lowest pressure for comfortable inside temperature.

Webster Float and Thermostatic Drip Traps are used on heating coils of air conditioners and drip points of the piping system.

Prefabricated Unit—Webster System Radiation convectors with copper tubing, aluminum fins, *integral* Webster Traps and Valves.



New! Webster Type WI Radiation for installation where floor or wall space is limited.

Also Radiator Traps and Valves, Strainers, Webster-Nesbitt Unit Heaters, Baseboard Heating

"I SAVED OVER $800 by installing forced warm air heating"

MR. R. D. STIEHL CO-OWNER OF H & S BOWLING ALLEYS IN AU GRES, MICHIGAN

"I intended originally to install wet heat...

... but after receiving estimates on such systems I investigated warm air heating and asked the same contractor (who was the low bidder on the wet heat installation) to estimate the entire job for forced warm air heat and in so doing saved $800.

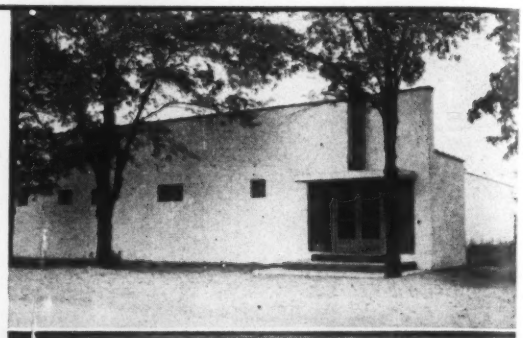
Actually our savings will run much more than that because . . . when we install a summer air conditioning system we will be able to use the ductwork of the heating plant and thus eliminate this feature for the air conditioner.

Air diffusers in the ceiling give an even heat throughout, and there are no heating units suspended from rafters or side walls to detract from the appearance of the interior decorations.

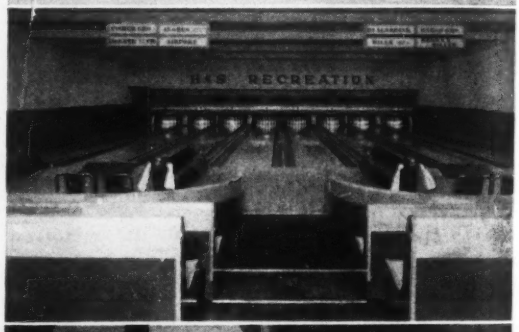
Mr. Edward Tarnosky of the Au Gres Plumbing and Heating Company, estimated both jobs and installed a Jackson & Church oil fired furnace, Model OL-48 with an output of 380,000 Btu's per hour.

My fuel consumption is low, and . . . the bowlers are comfortable because we have the added features of: 1. - frequent air changes, 2. - ample humidification, and 3. - filtered air. My partner, Mr. Roy Holland and I are very glad that we did not overlook the advantages of forced warm air heating." *

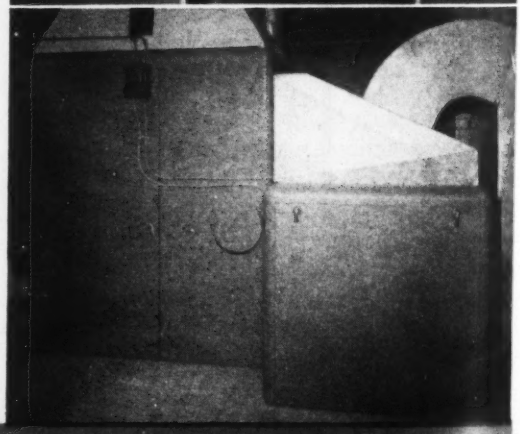
*Statement of Mr. R. D. Stiehl on file with Jackson & Church Company



New H & S Bowling Alley in Au Gres, Michigan



Interior view of H & S Bowling Alley (note improved appearance due to absence of suspended heating devices.)



Heating installation showing J & C PoweRated Model OL-48 with output of 380,000 Btu's per hour. Installed by Mr. Edward Tarnosky owner of the Au Gres Plumbing and Heating Company.

Memo: You too can save by installing forced warm air heat. See your nearest J & C dealer or write us at Saginaw.

J&C .... AMERICA'S LARGEST AND MOST COMPLETE WARM AIR HEATING LINE

INDOOR COMFORT

A PRODUCT OF

JACKSON & CHURCH CO., SAGINAW, MICHIGAN

"WORK WELL DONE SINCE '81"

Heating Piping & Air Conditioning

with which is merged the Aerologist

Design, Installation,
Operation, and Maintenance:
Industrial, Commercial, Institutional,
and Public Buildings

Board of Consulting and
Contributing Editors . . .

N. R. Bernz, Leo F. Collins, Sabin Crocker, R. C. Doremus, Philip Drinker, Walter L. Fleisher, F. E. Giesecke, William Goodman, William A. Hanley, J. J. Harman, R. S. Hawley, E. P. Heckel, R. E. Hieronymus, J. C. Hornung, John Howatt, Lee P. Hynes, C. W. Kimball, Dwight D. Kimball, A. C. Kirkwood, Charles S. Leopold, Samuel R. Lewis, H. C. Murphy, Alfred J. Offner, F. B. Rowley, Robert P. Schoenijahn, Kalman Steiner, T. S. Tenney, Rush D. Touton, Eph. A. Tyler, W. H. Wilson.

Editor.....C. M. Burnam, Jr.

Associate Editor.....Thomas V. Johnson

Advertising Staff . . .

Wallace J. Osborn
New York—Murray Hill 9-8293

Robert A. Jack
Cleveland—Yellowstone 1540

James D. Thomas
Chicago—State 2-6916

George C. Cutler
Chicago—State 2-6916

R. P. Wettstein
Los Angeles—Tucker 2779
Portland—Garfield 1903
San Francisco—Yukon 6-2522
Seattle—Alder 6365

Publisher.....Frank P. Keeney

Manager.....Charles E. Price

Production Manager....Lawrence A. Doyle

Published monthly by the Keeney Publishing Co., 6 North Michigan Avenue, Chicago 2, Illinois. Telephone: State 2-6916. Subscriptions: U.S. and possessions, $3.00 per year; Canada, Cuba, Mexico, Central America, South America, $4.00 per year; other, $6.00. Current copies, U.S. and possessions, 35c each; back copies, 60c each. January 1948 issue, $1.50 per copy. Member Audit Bureau of Circulations and Associated Business Papers, Inc.

Copyright 1948 by the Keeney Publishing Co.

November 1948 . . . . Vol. 20, No. 11

The Editor's Pages (news, notes, and comment)..... 65

How to Avoid Condensation Troubles When Using Cold Primary Air, by John Everetts, Jr..... 71

Sizing the Piping for Steam Supply and Condensate Return, by R. G. Lubinsky and M. J. Williams..... 76

Piping Sugar at Kroger's Saves Space, Cuts Costs, and Promotes Cleanliness..... 78

Air, Light, and Sound Controlled in Western Electric's New Plant.. 79

The NDHA Corrosion Tester—How It Performs in Use, by Leo F. Collins..... 83

Check Ventilation Needs of Unfamiliar Solvents..... 87

Air Conditioned Luxury Travel Featured by Twentieth Century... 88

Data Sheet—Average Monthly and Seasonal Degree Days..... 90

Air Sterilization and Human Health, by Burgess H. Jennings.... 93

Sam Lewis' Page—How to Purge Excess Oil from Big CO_2 Compressor..... 94

Agree on Standards for Refrigerant Piping..... 95

"Open for Discussion"—How to Analyze the Flexibility of Piping 96

Question of the Month—Air Conditioning to Protect Records.... 100

Madison Square Garden Gets New Piping..... 102

Equipment Developments..... 181

Executive Changes..... 198

New Books & Reports..... 203

Meetings & Conventions..... 207

Recent Trade Literature..... 210

Index to Advertisers..... 228

Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc.

Journal Section of the American Society of Heating and Ventilating Engineers

Heating a Basementless House With Radiant Baseboard, by R. H. Weigel and W. S. Harris..... 103

Performance of Residential Chimneys, by L. B. Schmitt and R. B. Engdahl..... 111

ASHVE Research Program..... 119

Nominees for 1949 Committee on Research—Three-Year Term... 121

Chicago to Have Biggest Meeting and Exposition..... 123

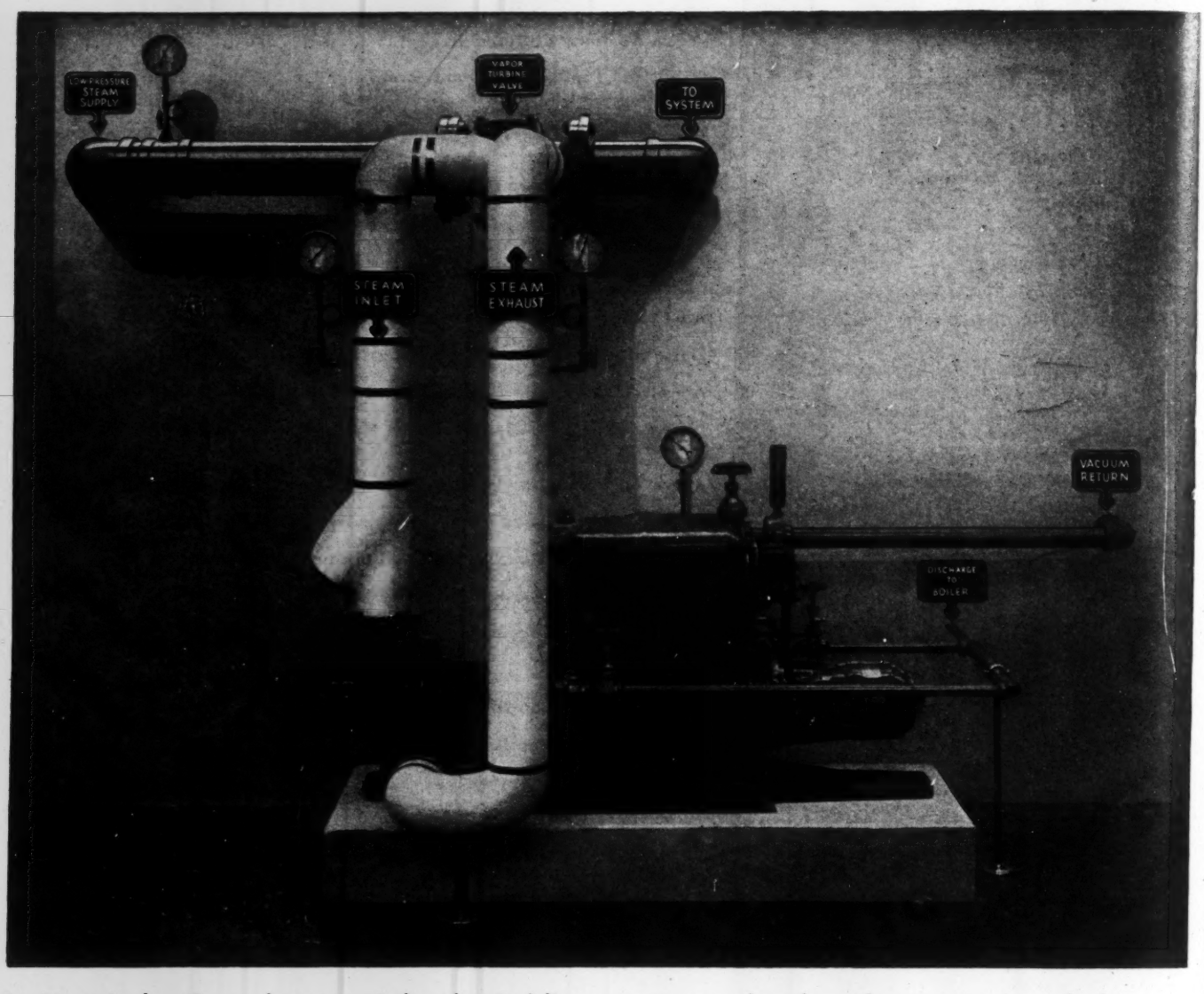
Program—55th Annual Meeting..... 124

Summary of Local Chapter Meetings..... 126

Candidates for Membership..... 128

Officers, Council, and Committees..... 131

Interrupted Electric Service will not stop this NASH Heating Pump



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

THE NASH ENGINEERING COMPANY

205-A WILSON ROAD, SOUTH NORWALK, CONNECTICUT, U. S. A.

How to Avoid Condensation Troubles When Using Cold Primary Air Ducts

Tests Yield Data on Insulation Methods

JOHN EVERETTS, JR., of Urdahl & Everetts, consulting engineers, Washington, D. C., says that condensation in air conditioning "is like a cold in the head—easy to get and difficult to get rid of." He reports here on some extensive tests made in connection with the air conditioning installations aboard three ships, but of importance in all types of air conditioning applications—particularly so with systems where a small amount of low temperature primary air is conditioned and distributed to units for the cooling of rooms, small offices, and small working areas

CONDENSATION IN air conditioning is like a cold in the head—unless suitable precautions are taken, it is easy to get and difficult to get rid of. It is a constant source of annoyance and drip and can develop into a serious hazard unless the proper corrective measures are taken.

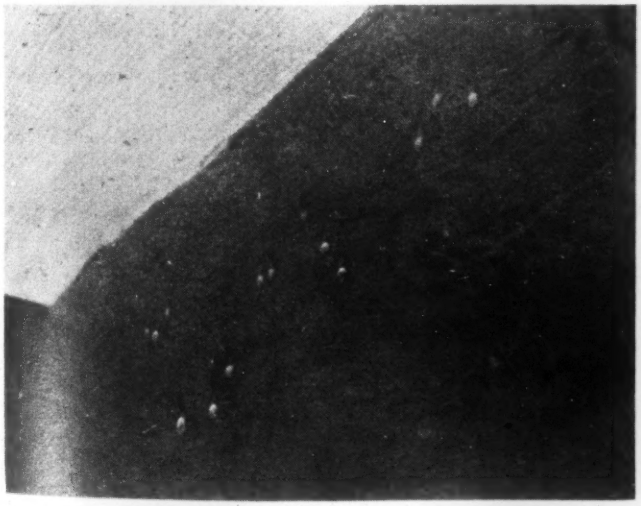
The problem is becoming increasingly important with the advent of air conditioning systems of the type where a small amount of low temperature air is conditioned and distributed to multiple recirculation units for the individual cooling of rooms, small offices, and small working areas. The primary air in such a system will have a temperature 8 to 10 deg lower than the dew point temperature of the air in the conditioned spaces and 25 deg lower than the dew point of the air in the nonconditioned spaces through which the ducts may pass. Under these conditions, the hazards of condensation are much greater than they are for other types of systems and greater precautions must be taken to prevent it.

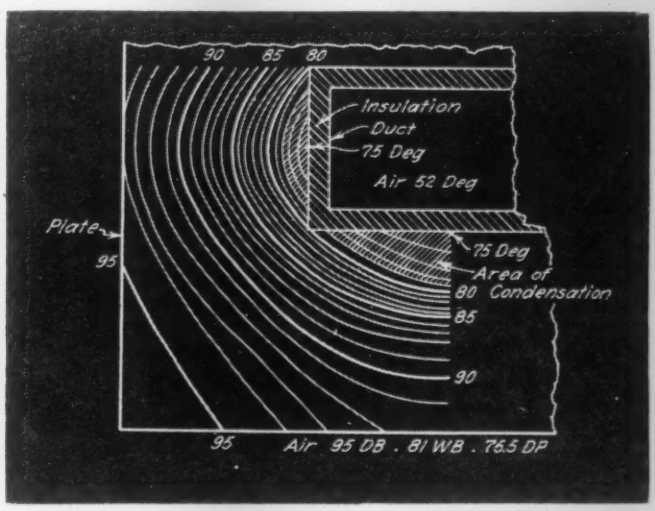
There are several points where condensation may be expected to form in this type of system:

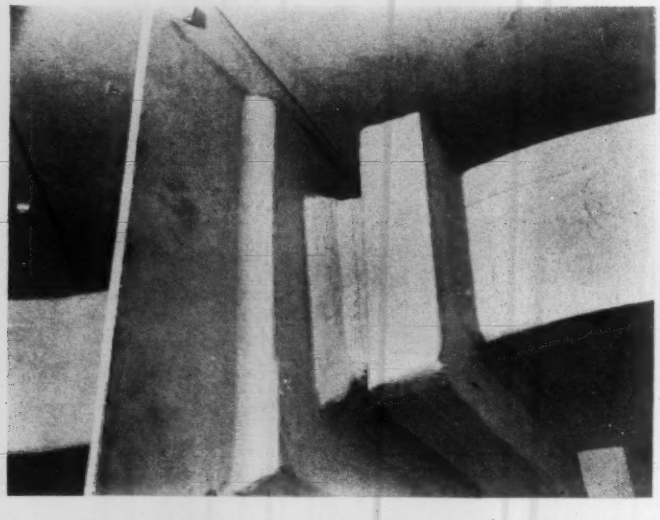
1) Where primary air ducts pass through walls, or watertight bulkheads of ships.
2) Flanged duct connections.
3) Duct hangers.
4) Metal insulation clips.
5) Exposed bolt heads.
6) Damper rod extensions.
7) Through poorly applied insulation.
8) Grilles and outlets.

Recognizing the possibilities of condensation hazards in the air conditioning being installed aboard the SS Lurline, SS Mariposa, and SS Monterey, the Matson Navigation Co. built a full scale mockup to simulate the ductwork, bulkheads, hangers, and insulation exactly in

Fig. 1 (left)—The duct was insulated up to the bulkhead on both sides, satisfactory with other types of systems but which caused condensation on the bulkhead with the primary air system. Fig. 2 (right)—Isotherm pattern for Fig. 1 tests.







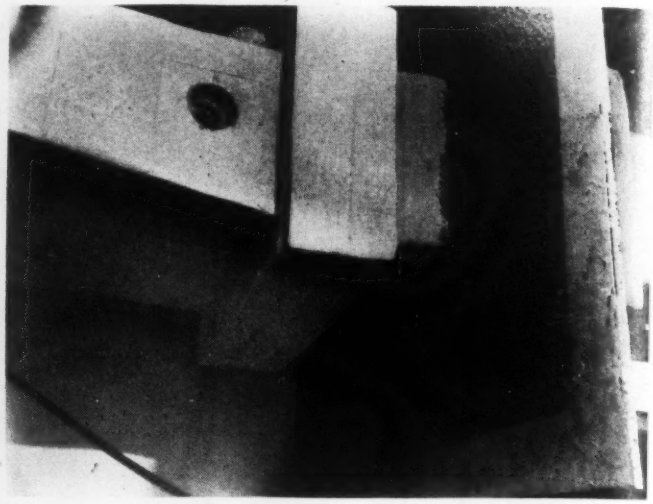


Fig. 3 (left)—Insulation was applied to the bulkhead for a distance of 6 in. from the duct. Condensation still formed, but not to as great an extent. Fig. 4 (right)—The insulation was removed and replaced with vermiculite.

accordance with the design plans. In this mockup it was possible not only to have 52 deg air flowing inside the duct but also to simulate the weather conditions which would be met in a Pacific ocean voyage by fluctuating the temperature and humidity conditions surrounding the duct. This would also apply to land installations where the weather fluctuations would be similar.

The conditions maintained in the room for the various tests were as follows:

Dry Bulb, F	Dew Point, F
100	80
95	75
90	70
85	65
80	60
75	55
85	80
75	70

The temperature of the air in the duct was maintained by means of automatic control through a refrigerating cycle. The temperature and humidity conditions in the room were maintained by both temperature and humidity control using heaters, humidifier, dehumidifier, and refrigeration. Each test ran over a period of 6 hr to make sure that temperatures and humidities had leveled off and that the temperature of the insulation, ducts, and bulkheads had come to equilibrium.

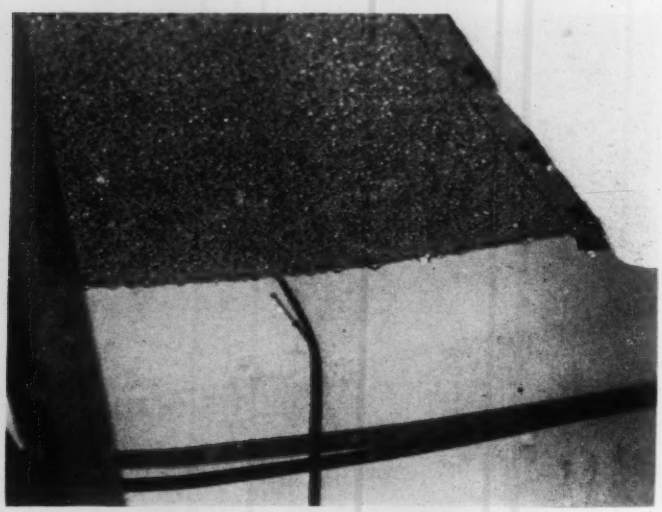
Readings of temperature and humidity were taken at 30 min intervals, as were observations to determine where and when condensation might be forming. Surface temperatures of insulation, ducts, and bulkheads were also taken to determine thermal patterns.

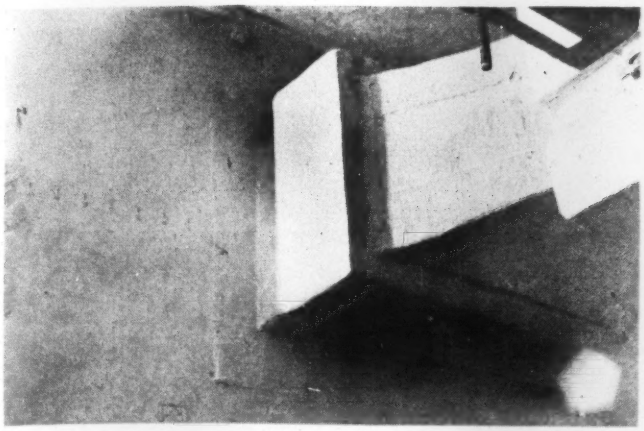
The test duct was constructed exactly the same as the ducts installed aboard ship and was insulated with 1 in. of fiber glass board cemented to the duct, covered with glass cloth, and painted. All joints were sealed with an approved cement compound.

Psychrometric readings were taken with an aspirating psychrometer and all surface temperatures were taken with a calibrated surface type pyrometer. It took approximately 3 to 4 hr after starting up for all surfaces and the space to reach equilibrium, after which readings were taken to obtain data.

There was little noticeable difference in results between conditions maintained with the 20 deg dew point depression and the 5 deg depression. With 52 deg air in the duct, the condensation would start

Fig. 5 (left)—When applied directly to the cold air duct, there was still condensation with the material used in Fig. 4. When applied to the bulkhead, it raised the temperature of the bulkhead above the dew point of the surrounding air and prevented the formation of condensation. Fig. 6 (right)—Example of improper sealing of insulation against bulkhead; humid air penetrated through the crack to the cold surface of the duct, causing condensation





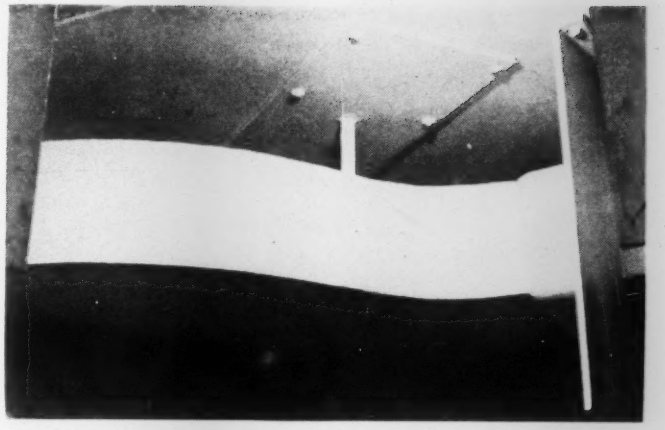


Fig. 7 (left)—If it is not necessary to break the joint, the insulation may be applied as shown here. Fig. 8 (right)—Normal procedure is to fasten the hanger directly to the duct, sometimes using a felt strip to separate hanger and duct.

to form at about 75 deg dew point and would spread rapidly with an increase of only 1 to 2 deg in dew point temperature.

The cold air duct was 6 by 12 in. and the ½ in. bulkhead plates to which the duct was welded extended 16 in. beyond the surface of the duct. Surface temperatures were taken at 2 in. intervals over the entire plate to determine the thermal patterns. After condensation started it was difficult to obtain surface temperatures because of the complex thermal changes which were occurring on the wetted surface. It must therefore be assumed that the temperatures shown in the wetted areas are somewhere between the actual temperature of the plate and the temperature of the condensate itself.

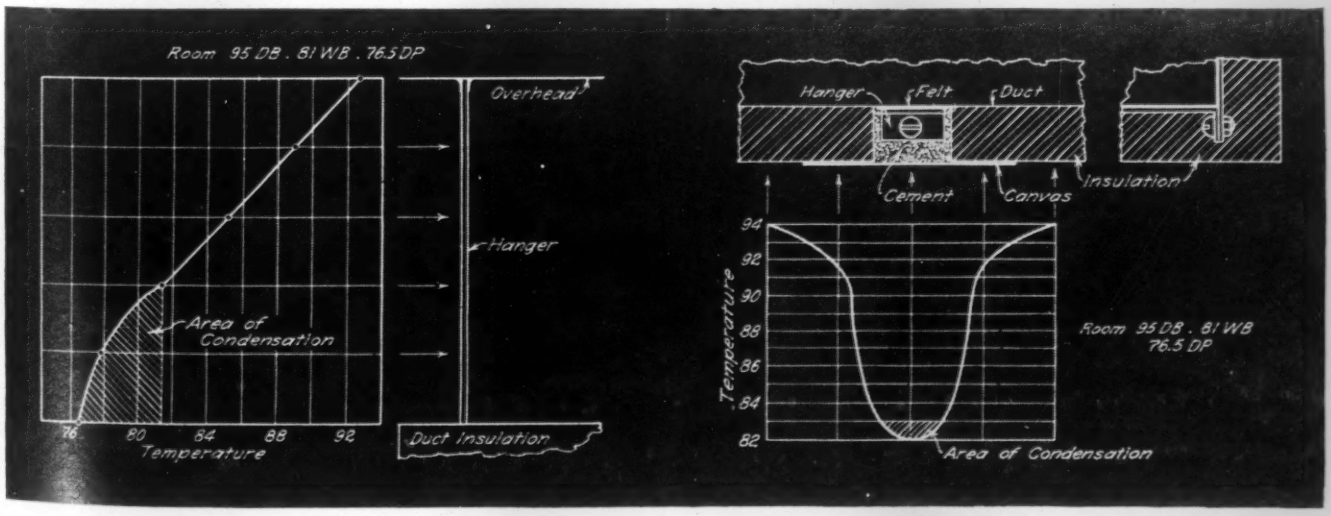
Marine air conditioning, unlike most shore installations, requires certain features of design made necessary to comply with Coast Guard safety regulations. For example, wherever a duct passes through a watertight bulkhead it is required that the duct be welded to the bulkhead to prevent the passage of water should one of the watertight compartments become flooded through damage. This means that the bulkhead acts as a secondary surface to the duct (the same as a fin on a heating or cooling coil).

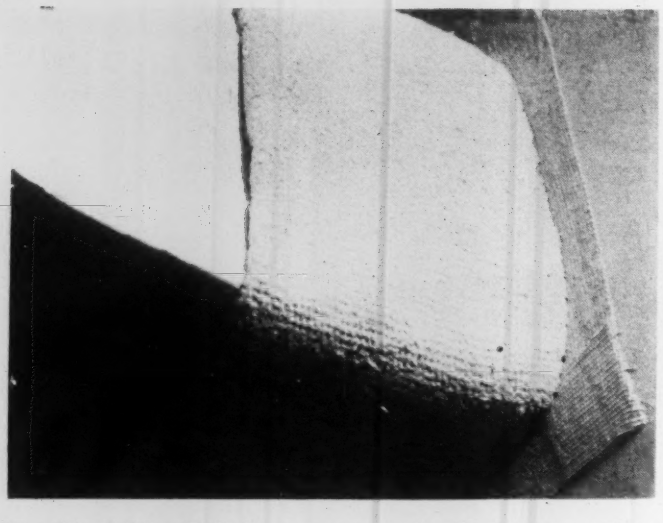
Primary Air Ducts Passing Through Walls

The duct is insulated up to the bulkhead on both sides which, for other types of systems, proved quite satisfactory. But with the primary air system, condensation on the bulkhead became a serious problem. An example of this is shown in Fig. 1. The isotherm pattern and psychrometric conditions for this particular test are shown in Fig. 2.

It was noted during the test that when condensation began to form, it spread quite rapidly over the period of a few minutes; the reason for this is that, upon formation of the condensation, the surface temperature of the bulkhead could only approach the wet bulb temperature of the air instead of the dry bulb temperature when the bulkhead was dry. The wet bulb (being lower than the dry bulb) creates an additional cooling effect, therefore increasing the area of low temperature—which accelerated the formation of the condensation. The temperatures indicated on the isotherm pattern, Fig. 2, show temperatures in the area of condensation higher than the dew point of the room and it is quite obvious that these tem-

Fig. 9 (left)—Condensation was formed on the hanger external to the insulation for approximately 2 in. Curve shows temperature gradient in hanger strap. Fig. 10 (right)—The exposed portion of the hanger was not the only part that gave trouble. Where the side strips of the hanger were bolted to the bottom bar supporting the duct, the insulation thickness was not increased and condensation formed on the surface of the insulation over the bolted joint.





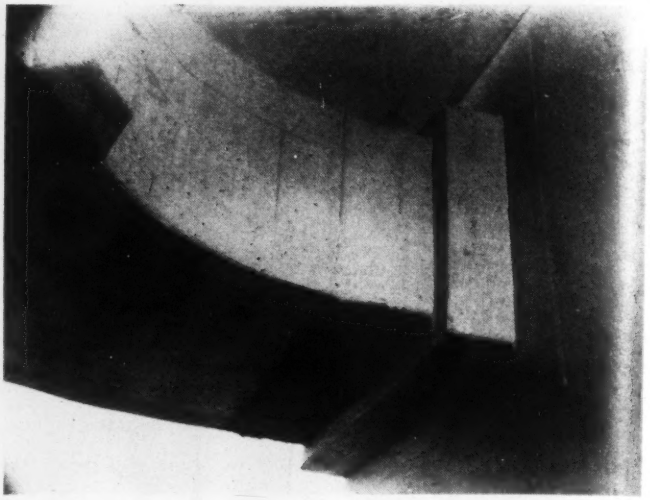


Fig. 11 (left)—If it is necessary to break the connections periodically for cleaning or access, then the flanges may be wrapped with asbestos cloth. Fig. 12 (right)—Insulation was fastened by a metal clip tack welded to the duct. The clips were cold enough to form condensation, so a coating of vermiculite was applied as a temporary expedient

peratures were that of the condensate rather than that of the bulkhead.

Insulation was then applied to the bulkhead for a distance of 6 in. from the duct, as shown in Fig. 3. The tests were repeated and it was found that condensation again formed—but not to as great an extent as without insulation. The reason for this is that the insulation merely extended the low temperature portion of the bulkhead farther away from the duct. (In other tests aboard naval vessels, it was found that insulation applied for a distance of 12 in. from the duct prevented the formation of condensation; however, this was impossible in this case because of space limitations and design).

The insulation was removed from the bulkhead and replaced with vermiculite as shown in Fig. 4, and the tests repeated. No condensation appeared throughout the tests. This material, applied as it was in a thin coat, is not a primary insulator, as evidenced in Fig. 5 where it was applied directly to the cold air duct. When applied to a smooth surface as a thin coat, it increases the surface area four to six times. Thus, when applied to a secondary surface such as the bulkhead it increased the rate of heat absorption four to six times, thus raising the bulkhead temperature above the dew point of the surrounding atmosphere and preventing the formation of condensation.

Wherever flanges are necessary to connect ductwork, particularly in a primary air system, they should be insulated to the equivalent thickness of the duct insulation. This may not be satisfactory from an aesthetic point of view—but neither is condensation dripping down from a ceiling or side wall and ruining costly interior decorations. If it is not necessary to break the joint, the insulation may be applied as shown in Fig. 7. If it is necessary to break the connections periodically for cleaning or access, then the flanges may be wrapped with asbestos cloth as shown in Fig. 11. This method will permit the removal of the insulation and its replacement.

The tests showed that where the insulation was not built up to the equivalent thickness of that on the duct, condensation would form, soak into the insulation on either side of the flanges, and eventually the insulation would become completely ineffective.

Tests With Duct Hangers

Duct hangers in an air conditioning system normally get very little attention, yet in this particular application they can cause no end of grief. The normal procedure is to fasten the hanger directly to the duct, sometimes using a felt strip to separate the hanger from the duct, and then insulate the duct and hanger. Fig. 8 shows such an arrangement.

Tests were conducted and condensation was formed on the hanger external to the insulation for approximately 2 in., as shown in Fig. 9. The condensation would then run down the hanger, soaking the insulation. While this was serious in itself, a greater problem resulted from the normal vibration of the duct—which caused separation of the insulation at the hanger, allowing humid air to penetrate to the cold surface of the duct and thus leading to considerable damage to the insulation.

The exposed portion of the hanger was not the only part that gave trouble. Where the side strips of the hanger were bolted to the bottom bar supporting the duct, the insulation thickness was not increased and condensation formed on the surface of the insulation over the bolted joint, as shown in Fig. 10.

To correct this problem, external hangers were applied after the insulation was completed. Temporary hangers were used to support the duct until the permanent ones could be installed. The new hangers were designed with sufficient supporting surface to prevent the crushing of the insulation.

Metal Insulation Clips Investigated

The insulation was fastened to the duct work by means of a metal clip tack welded to the duct, insulation forced over it, and the clip bent over to hold the insulation. During the tests these clips were sufficiently cold to form condensation and as a temporary expedient a coating of vermiculite was applied as shown in Fig. 12, which was only partly effective. Where the underside of the clip was firmly imbedded in the insulation this method was satisfactory; however, if the clip was not bent up tightly and allowed air to reach the underside of it then condensation would form.

Exposed Bolt Heads Cause Trouble

Bolts in contact with primary air are left uninsulated in many places and cause condensation drip which can result in serious damage. Such places as flexible fan connections, cooling coil connections, connections to local recirculation units, and many others should be insulated. Fig. 13 shows one example; if the bolt heads were left uninsulated, the condensation would have dripped through a fancy ceiling which cost thousands of dollars to decorate.

Damper Rod Extensions

Damper rods, quadrants, and other such mechanisms should be readily accessible for adjustments and control—which is difficult if they are hidden somewhere under the insulation. They must be insulated, of course, otherwise condensation will form and damage will result. One method is to use an insulated plug or removable cover which is clearly marked to indicate whether it is over a damper adjustment, access plate, or extension of a damper rod.

Insulation Poorly Applied

Regardless of how carefully an engineer may design a system or how tightly he may write the specifications, the system can be a mediocre one (or even a dangerous one) if the installing contractor is not sufficiently alert to exercise control over his inspection force. With the shortage of skilled labor existing today, it is practically impossible for a contractor to employ a complete force of first-grade experienced mechanics. Consequently, he must exert more effort and time in training his inspection staff in details of construction and installation. This will not only save the contractor money but will reduce maintenance costs of the system and make all concerned feel much happier.

Fig. 6 shows one example of improper sealing of insulation against the bulkhead. Humid air penetrated through the crack to the cold surface of the duct, causing condensation which would eventually ruin the insulation. Fig. 12 shows how this should have been sealed to prevent costly damage.

Condensation at the Air Outlets

With air conditioning designs going to lower and lower primary air temperatures, the problem of condensation at the outlets becomes more pronounced. This is particularly true of systems which are shut down over weekends and where the dew point in the conditioned area has been allowed to build up through natural infiltration, washing down of the floors, or other causes.

To prevent condensation at grilles and outlets under these conditions becomes an operational problem rather than one of design in which the primary air, either through manual or automatic control, will be cooled gradually until the conditioned space dew point is low enough to permit the introduction of the mixture of primary and secondary air under design conditions. This gradation of time is dependent upon the individual installation and the area in which it is located.

When the corrective measures outlined above were taken on the SS Lurline, the tests on her maiden voyage to Honolulu showed no signs of condensation, whereas other ships with similar systems reported serious problems costly to correct.

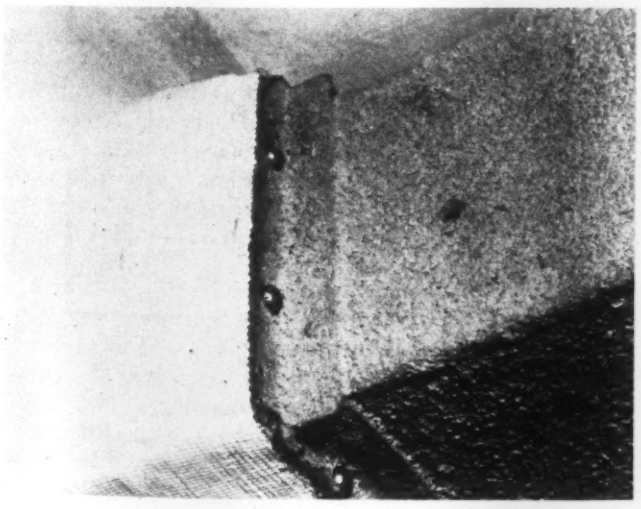


Fig. 13—If the bolt heads in this example had been left uninsulated, the condensation could have dripped through an expensive ceiling

Your January issue will include a complete and up-to-date Directory Section of Heating, Piping, and Air Conditioning Equipment for Industrial, Commercial, Institutional, and Public Buildings.

There is no question that there are many economic advantages of the high pressure, low temperature primary air system of air conditioning where many small spaces are involved; however, it must be recognized that the design and installation problems are more acute in some respects than with other types of systems—particularly from the condensation hazard standpoint. One answer to this, of course, is to remove the source of trouble.

Partially Cool Primary Air?

In most such systems, the primary air is usually the outside air brought in for ventilation purposes. The secondary air with which the primary air is mixed in a room unit is recirculated air from the conditioned room. If this primary air, instead of being cooled to low temperature, were dehumidified and only partially cooled and then delivered to chilled water coils to do the sensible cooling of the room, there could be no condensation hazard from the primary air.

So long as the dew point of the primary air is kept below the chilled water temperature, there will be no condensation at the units if the system is properly operated. For example, if, when starting up the system, the dehumidified air is permitted to circulate without cooling, it will gradually reduce the dew point of the conditioned space below the chilled water coil temperature. At this point, the chilled water system can be started.

This arrangement can eliminate the necessity for insulating the primary air duct; however, it does require a chilled water piping system which must be insulated. Piping insulation is, however, easier to apply and is far less complicated than is insulating ducts, flanges, transformations, damper rods, etc. The elimination of insulation on the primary air duct also reduces the overall size of the duct, which is vitally important where low ceiling heights are prevalent.

SIZING the Piping for Steam Supply and Condensate Return

By R. G. LUBINSKY and M. J. WILLIAMS, manager of the fan and heating coil sales department, and manager of the plan engineering department, respectively, the Trane Co., of La Crosse, Wisconsin.

Success or failure of a carefully designed steam heating system often hinges on the correct sizing of the supply and condensate return piping. The fact that this seemingly minor factor is often underestimated is apparent when you recall the number of jobs that are noisy, develop air binding and water hammer, or just don't heat properly. The great majority of these malfunctions can be traced to improper pipe sizing.

This trouble arises frequently because of the lack of information on correct pipe sizing and the philosophy of letting the other fellow do it until it gets so far down the line that the piping suffers and the whole job sours. Actually, pipe sizing is not difficult, nor does it require an extensive engineering background. However, there are many points to be remembered.

Depends Upon Three Factors

First of all, the determination of correct pipe sizes for a given steam load depends on these three principal factors:

1) The initial pressure and the total pressure drop which may be allowed between the source of supply and the heating unit farthest removed from the boiler. The initial steam pressure in most cases is the gage pressure at the boiler. Then the allowable pressure drop is the difference between the desired operating pressure at the supply side of the heating unit farthest removed and that at the boiler. Normally, in a system using 25 psi or higher, the allowable pressure drop should not exceed 30 percent of the initial pressure.

2) The maximum velocity of steam allowable for quiet and dependable operation of the system, taking into consideration the direction of the condensate flow. This factor is important in single pipe systems where steam and condensate flow in the opposite directions, in which case the velocity is limited to eliminate objectionable noise built up between the counterflowing water and steam. Velocity, in this case, should not exceed 1200 fpm. Where steam and condensate flow in the same direction, velocity of the steam may be increased considerably. In considering high pressure systems with large capacity heat transfer equipment installed, the factor of velocity is important primarily from the standpoint of economy in pipe sizes. A higher velocity means a reduction in pipe size, and consequent reduction in cost—but it also means a higher pressure drop. A balance must be obtained between the size of the pipe and capacity of the farthest removed heating unit so that the overall cost will be the most economical and yet maintain satisfactory performance of the system.

3) The equivalent length of the run from the boiler or source of steam supply to the farthest heating unit. The equivalent length of pipe in a steam system is the actual length of run plus the resistance set up by pipe, fittings, and valves expressed in feet of straight pipe. Since the equivalent length of pipe is generally not known at the outset, it is a common and practical method in figuring high pressure systems to assume a total equivalent length of 1½ times the measured length and then check this assumption after the pipes are sized.

Piping layout for a typical factory building, sizing for which is explained in the text. The blast coil has 127 lb per hr steam capacity. The projection unit heaters (numbered 1 through 7) each have 175 lb per hr steam capacity, and the horizontal unit heaters (A and B) each have 68 lb per hr capacity. Pressure at the boiler is 55 psi and the pressure drop is 5 psi

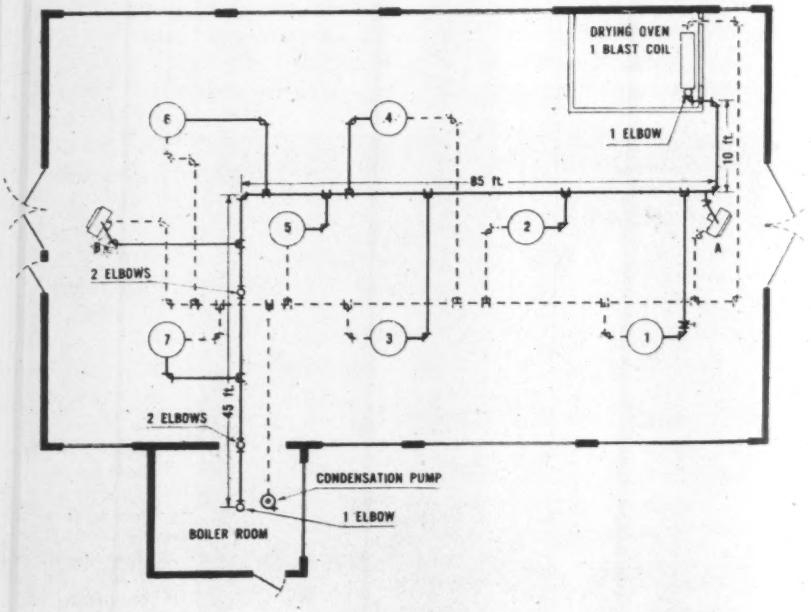


Table 1—Steam pipe capacity, lb per hr—50 psi steam
(Steam and condensate flowing in same direction)

Pipe size, in.	Pressure drop, psi per 100 ft of pipe length					
	¼	½	¾	1	2	5
¾	27	38	47	54	76	120
1	54	77	94	110	150	240
1¼	120	170	210	240	340	530
1½	180	260	320	370	520	830
2	370	530	650	750	1,060	1,680
2½	620	870	1,070	1,240	1,750	2,760
3	1,130	1,600	1,960	2,270	3,200	5,060
3½	1,690	2,390	2,930	3,390	4,780	7,560
4	2,390	3,380	4,150	4,790	6,760	10,690
5	4,420	6,250	7,670	8,860	12,500	19,780
6	7,260	10,260	12,590	14,540	20,520	32,470
8	15,120	21,360	26,210	30,280	42,720	67,590
10	27,580	38,980	47,840	55,250	77,960	123,300
12	44,270	62,560	76,780	88,680	125,100	197,900

Table 2—Equivalent length of pipe to be added for fittings

Size of pipe, in.	Length in feet to be added to run				
	Standard elbow	Side outlet tee	Gate valve(*)	Globe valve(*)	Angle valve(*)
½	1.3	3	0.3	14	7
¾	1.8	4	0.4	18	10
1	2.2	5	0.5	23	12
1¼	3.0	6	0.6	29	15
1½	3.5	7	0.8	34	18
2	4.3	8	1.0	46	22
2½	5.0	11	1.1	54	27
3	6.5	13	1.4	66	34
3½	8.0	15	1.6	80	40
4	9.0	18	1.9	92	45
5	11.0	22	2.2	112	56
6	13.0	27	2.8	136	67
8	17.0	35	3.7	180	92
10	21.0	45	4.6	230	112
12	27.0	53	5.5	270	132

*Valve in full open position.

Table 3—Gravity, vacuum, and high pressure return pipe capacity, lb per hr

Pipe size, in.	Low pressure		High pressure return, steam pressure in psi					
	Gravity return	Vacuum return	25	50	100	150	200	250
¾			236	312	419	560	682	1,074
1	200	350	474	617	823	1,120	1,385	2,150
1¼	400	600	989	1,306	1,755	2,330	2,880	4,450
1½	700	950	1,610	2,126	2,850	3,800	4,710	7,350
2	1,200	2,000	3,280	4,325	5,785	7,700	9,550	14,875
2½	1,650	3,350	5,400	7,160	9,640	12,800	15,850	24,600
3	2,600	5,350	9,890	13,070	17,550	23,300	28,850	34,750
3½	3,800	8,000	14,700	19,400	25,900	34,500	42,700	51,350
4	6,500	11,000	20,800	27,360	36,550	49,200	60,900	73,350
5	10,400	19,400	38,850	52,925	70,000	91,500	114,500	127,600
6	18,000	31,000	61,200	83,700	112,700	150,000	185,500	223,100

For instance, consider the following installation design. A steam heating system is designed to handle the heating of a factory plus process heat needed for a drying operation. The factory is heated by large unit heaters while the drying operation uses blast heating coils. The steam supply or boiler room is in an adjacent building and the blast coils are the heating units farthest removed from the boiler.

Sizing Pipe for a Factory Building

The engineer designing the job recommended a boiler pressure of 55 psi. As indicated on the piping layout the actual piping of the steam main amounts to 140 ft. The blast coil in the drying oven operates at 50 lb steam pressure to condense 127 lb per hr of steam. The horizontal unit heaters, operating at 50 psi, each condense 68 lb per hr of steam and the vertical unit heaters condense 175 lb per hr of steam.

With this information, it is now possible to start sizing the pipe.

First figure the total actual length of the steam main to the blast coil (140 ft) and multiply it by 1½ to get an approximate equivalent length of pipe (210 ft).

The allowable pressure drop per 100 ft, with an allowable pressure drop of 5 psi, is then figured as (100 × 5)/210 or 2.3 psi. This provides a guide in using the pipe sizing table.

Starting with the blast coil—the farthest heating unit—we use Table 1 to compare the 2 psi pressure drop per 100 ft with the 127 lb steam condensing capacity to discover that a 1 in. pipe will handle the job.

Moving back toward the boiler, we add the condensing capacity of the horizontal unit heater (*A*) to our coil load (127 + 68) to get a total of 195 lb per hr. Referring again to Table 1, we find that a 1¼ in. main is needed now.

Vertical heater No. 1 adds 175 lb capacity to give a 370 lb per hr (195 + 175) load and increase the main to 1½ in. pipe.

Unit	Accumulated steam load, lb per hr	Correct main size, in.
2	545	2
3	720	2
4	895	2
5	1070	2½
6	1245	2½
B	1313	2½
7	1488	2½

Now check with Table 2 to determine if the equivalent length was correct. There are 10 elbows in the main to the blast heater. Four of these elbows are 1 in. size, adding 8.8 ft to the actual length. The remaining elbows are 2½ in. size and add 30 ft for a total of (30 + 8.8) or 38.8 ft or 178.8 ft equivalent length of pipe.

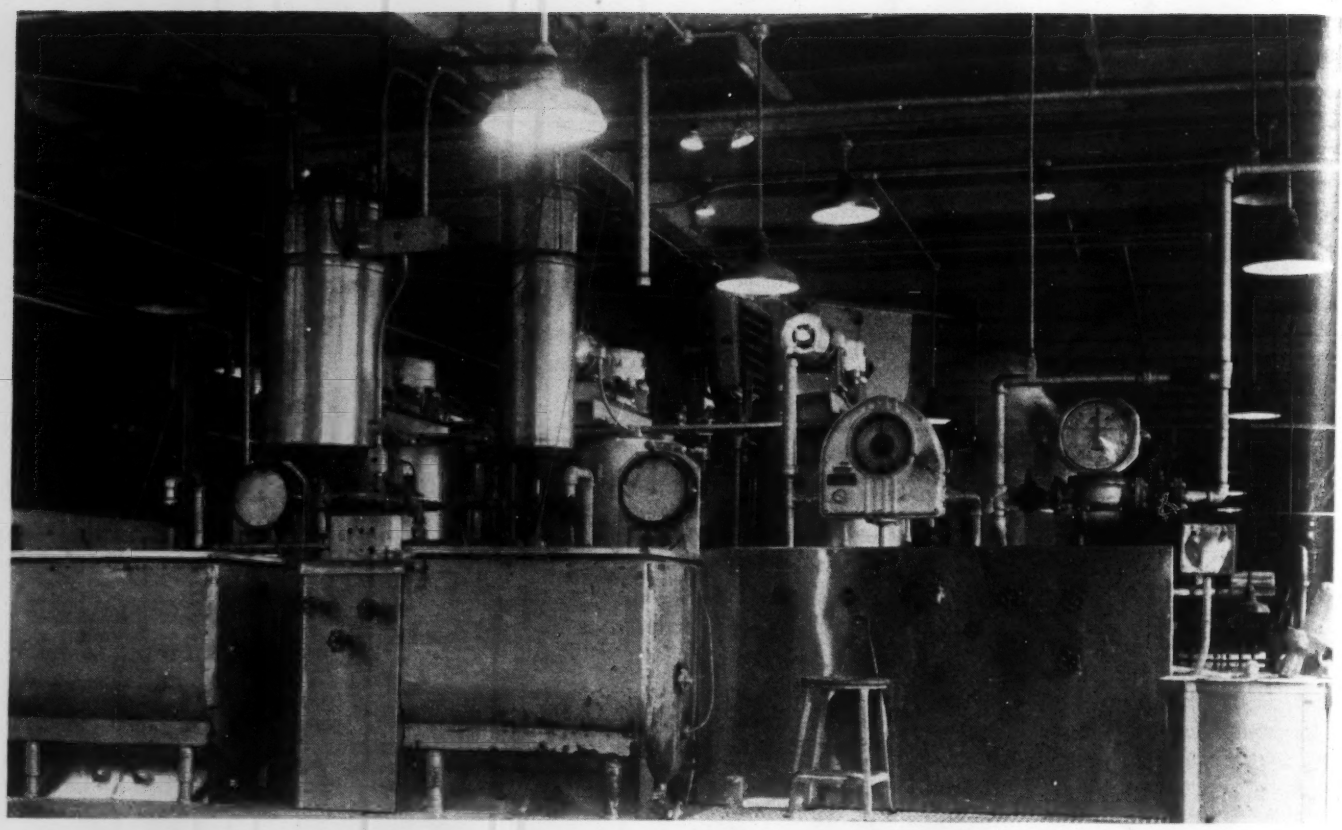
Using this figure in place of our estimated 210 ft, we find the allowable pressure drop to be (100 × 5)/179 or 2.8 psi, which falls in the same category as our estimate and double checks the pipe sizing to be correct.

Sizing the returns is accomplished in a similar manner using Table 3.

Unit	Accumulated condensate load, lb per hr	Correct return pipe sizes, in.
Coil	127	¾
A	195	¾
1	370	1
2	545	1
3	720	1¼
4	895	1¼
5	1070	1¼
6	1245	1¼
B	1313	1½
7	1488	1½

Even in the most complicated piping system the correct sizing of pipe is comparatively easy since it is broken down into small units starting at the unit farthest removed from the source and building up to the boiler.

Improper pipe sizing can often be the bottleneck in an otherwise well-planned system. It is imperative to have the correct size of pipe to get the most efficient performance from whatever heating units are installed in the system.



The salad dressing department at Kroger's. The meter on the right with the bypass system is the liquid sugar line

Piping Sugar at Kroger's Saves Space, Cuts Costs, and Promotes Cleanliness

300 Tank Cars Annually Used for Beverage, Jam and Jelly, Candy, Baked Bean, and Salad Dressing Plants

THE LARGEST liquid sugar handling system believed to exist anywhere was recently put into operation at the Kroger Co.'s manufacturing division in Cincinnati. The project, which is estimated to have cost $100,000, includes five 17,500 gal capacity steel storage tanks and more than 1000 ft of pipe, in addition to a foundation, a railroad siding, and housing.

From the base storage tanks, liquid sugar flows to the bottle beverage plant and to the jam and jelly, candy, baked bean, and salad dressing plants. This is "the first time in the history of liquid sugar" that a single storage station has been built to accommodate five different food plants.

These five plants will require about 300 tank car deliveries of liquid sugar per year. Tank cars designed especially for the safe transportation of liquid sugar range in capacity from 6000 to 10,000 gal, and a 10,000 gal car can be emptied in about 2 hr, according to Vincent Gage, technical representative of Refined Syrups & Sugars, Inc., of Yonkers, N. Y. The latest model cars are welded throughout and have 4 in. fiber glass insulation that helps maintain the liquid sugar at the desired temperature.

In preparation for receiving liquid sugar, Kroger extended its receiving platform by about 60 ft to permit two tank cars to be drawn up without interfering with the unloading of other freight cars habitually arriving. It utilized for this extension a centrally located section of the yard that had been idle. The conversion of this dead space and of warehouse areas formerly used for the storage of dry sugar bags to productive use is one of the factors that led Kroger's to adapt this new form of industrial sugar to its own needs, according to George Bunker, vice president in charge of manufacturing. Reduction in handling costs, ease of handling, and the cleanliness of liquid sugar also contributed to this decision.

The storage tanks at Kroger's are lined with glass, and are equipped with sterile lamps and a ventilating system. As the sugar is needed in the mixing rooms, a turn of a valve starts it flowing through pipes at the rate of 40 gpm. Going direct into the mixing tanks without exposure to the air, the sanitary precautions observed in the manufacture and distribution of liquid sugar are continued to the ultimate point of use.

Air, Light, and Sound Controlled in Western Electric's New Plant

Built to combine ideal working conditions (with complete atmospheric, light, and sound control) with a degree of flexibility seldom attained in a factory, the new Western Electric Co. electronics plant at Allentown, Pa., has three 770 ton centrifugal refrigeration compressors for air conditioning, insulated side wall and roof construction, 40 miles of piping for process

COMPLETION of Western Electric Co.'s new electronics plant at Allentown, Pa., marks a climax in an architectural trend started 18 years ago, when basic plans for "the world's first controlled conditions factory" were made.

Perched on a 50 acre hillside tract, overlooking green farmlands in the Lehigh valley lying between it and the city proper, this latest addition to the Bell System's manufacturing facilities reflects the progress of construction industries in meeting the exacting requirements for manufacture of the precision electronic apparatus on which modern telephony, radio, and other communication systems depend. Built and equipped largely with products unknown when the first plant with complete atmospheric, light, and sound control was conceived, it combines ideal working conditions with a degree of flexibility seldom attained in a manufacturing plant.

Designed and built by the Austin Co., engineers and builders, under the supervision of Western Electric's engineer of plant, after an exhaustive study of other plants where comparable means to insure quality control in products ranging from bombsights, saws, and super-powered aircraft engines, to small electric motors, seaplanes and the heaviest bombers, had been employed, this plant goes them all one better.

Here, for the first time, is found a plant where the endless and fast changing demands of electronics manufacture can be immediately satisfied without major expenditure or alterations. The 100 ft clear spans provided throughout four 325 ft aisles in the main manufacturing area, and the arrangement of special process departments and employee facilities around the perimeter of the plant, where the wide range of air conditioning requirements can be met efficiently, plus an amazing "over and under" layout of service piping and power distribution lines, are the things that give this plant an edge on Father Time's twin brother "obsolescence."

The use of packed wood and maple throughout the main manufacturing floor makes it possible to establish direct power and multiple service line connections for any machine at any desired location on this level. It is a simple matter to bore a few holes in the floor and set up the required branch connections to the distribution lines just below the ground floor ceiling. These lines are almost equally accessible to more than 5000 different machine locations throughout the plant's two floors—the only difference being that ground floor connections are overhead, while those for the main or upper floor, which is devoted entirely to production, can be made at floor level, so that the space overhead remains unobstructed.

Similar flexibility in the lighting and atmospheric control systems, and the overall use of advanced acoustical and insulation materials, round out the combination which makes this plant a unique example of controlled conditions design.

The side walls, for instance, have a core of 1 in. fiber glass insulation,

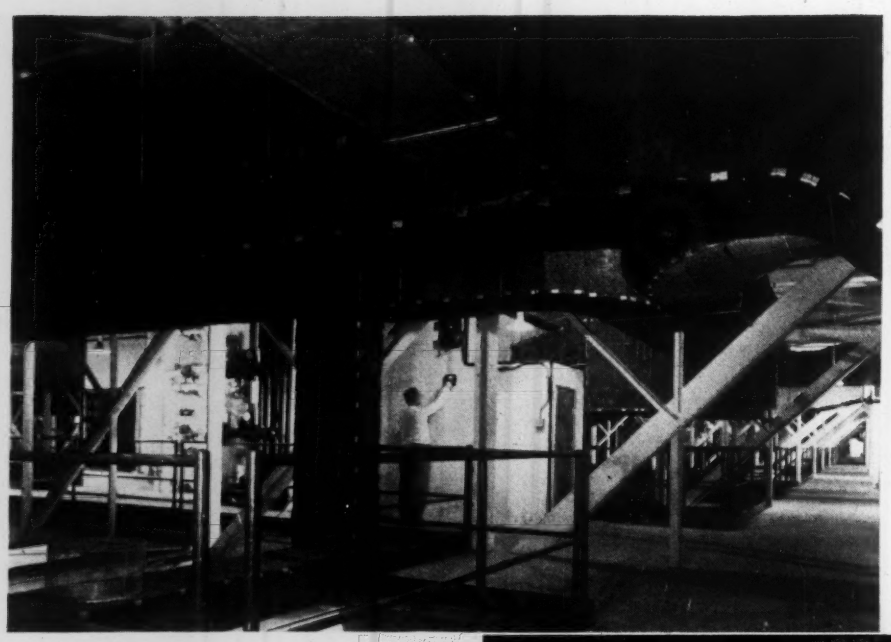
Front Cover Photo

The instrument board in the monitoring room at Western Electric Co.'s new electronics plant gives the engineer in charge the full picture of atmospheric conditions throughout the plant at one glance.

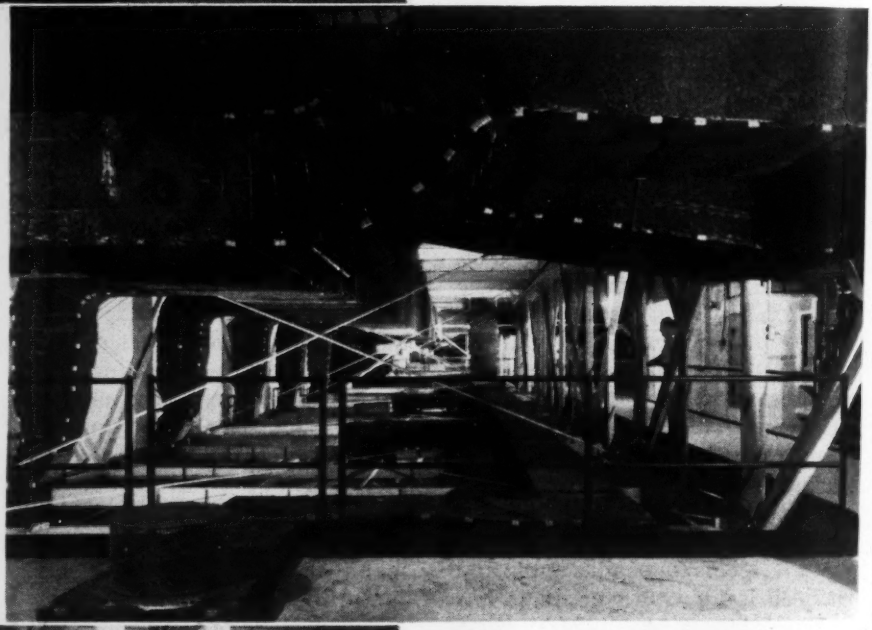
Pushbuttons on the small panel in the lower right corner enable the engineer to obtain instantaneous temperature readings at any one of 48 points in the plant, thus giving him an accurate means of checking the operation of the plant's 17 individual air conditioning systems.

Since the main manufacturing area is operated under positive air pressure of 1/16 to 1/8 in. of water to insure direct exhausting of vapors originating in special process departments around the perimeter, pressure gages in the upper corners are likewise important.

Signal bells and visual signal panels in the three center sections above monitor the plant's hydrogen and smoke detection systems. The latter is controlled by photo-electric cells installed in each of the individual air conditioning units, and would sound an alarm if there were sufficient smoke to cause a 4 percent reduction in the intensity of light passing through return air ducts. In case of an emergency, the engineer in charge could instantaneously adjust the controls from this point to effect a complete air change throughout the building within 10 min.

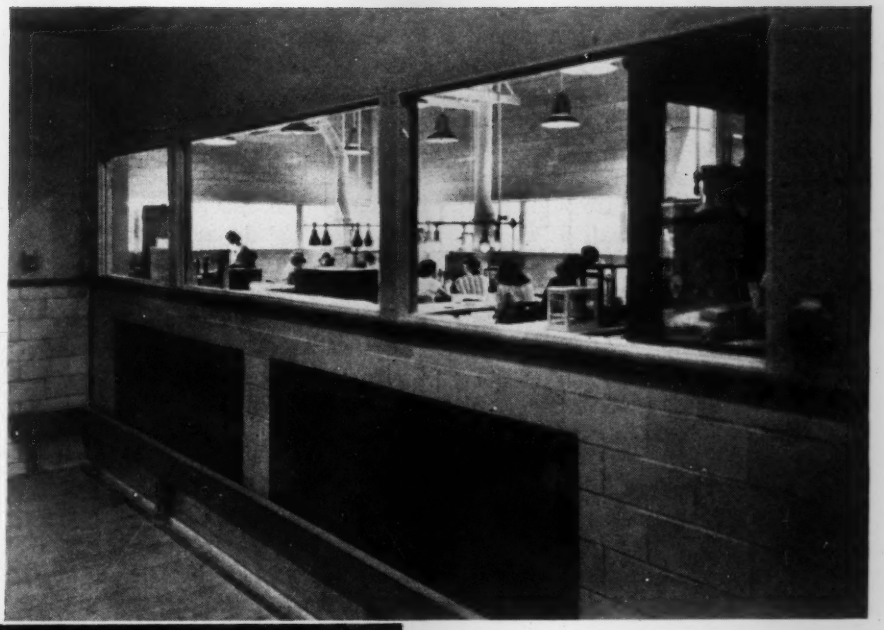


This air conditioning unit and duct work on the mezzanine is typical of six identical installations serving the main manufacturing area. The platforms, equipment, and mezzanine floor areas extend through the welded 100 ft span trusses which provide a maximum of unobstructed working space directly below. The entire truss area serves as a vast plenum chamber from which return air is drawn back into the air conditioning system through pneumatic dampers, like those on the extreme left, and mixed with outside air which is drawn in through penthouse intakes and then over air filters, heating, and cooling coils. Each of these units has a capacity in excess of 50,000 cfm and distributes air through cork insulated ducts to 35 air diffusers over an area of approximately 22,000 sq ft. Refrigeration is provided by a battery of three 770 ton centrifugal compressors in the adjoining boiler house.



Four identical air conditioning systems, like that seen in part in the right background, serve the individual offices, processing departments and employee service areas around the perimeter of the main floor through double duct systems, with individual thermostatic mixing damper controls in the ducts just above the points at which they enter the individual areas. Two of the main distribution ducts can be seen overhead, extending into the background above on the left. Branches serving the individual rooms can be seen on the left, where they extend down to outlets on the sidewalls of the low roofed peripheral leanto areas. The duct work extending parallel to the 100 ft trusses on the right is served by another unit out of sight in the background and supplies air to one corner of the main manufacturing floor through branch outlets which are clearly indicated. The wire screen cages are located above the return air outlets in the center of the air diffusers through the outer sections of which the conditioned air is supplied. Removable railings of $1\frac{1}{4}$ in. welded pipe are installed around all sections of the mezzanine, which are also protected by a metal kickplate.

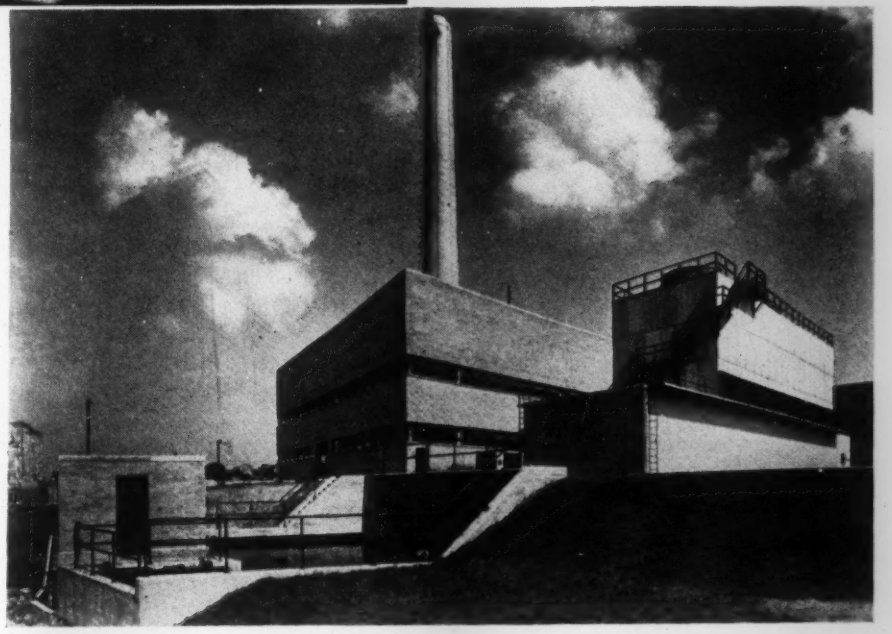
This ceramic preparation department is one of 20-odd special process areas whose individual air conditioning and special ventilation requirements have been effectively met by their arrangement in the 25 ft leanto section surrounding the main floor of the plant. They are separated from the main manufacturing area just beyond the partition on the left by windowed partitions with glazed tile below the sash line and asbestos cement board above. Four double duct air conditioning systems serve all the perimeter rooms, each of which has its own set of thermostatic damper controls and supplementary ventilating equipment, where this is needed. Positive pressure is maintained in the air conditioning system serving the large area, from which some of the air is exhausted to the perimeter rooms through louvered openings like those directly above the windows on the left. Special insulation in the roof and outside walls, together with double glass in the vision strip, reduce heat transfer to a minimum.



This view, looking from the aisle surrounding the main manufacturing area into the cathode coating department in one corner of the building, shows how highly specialized functions have been isolated. The use of volatile materials in this department required the installation of explosionproof equipment and complete isolation of the area's air conditioning system, so that here ventilating louvers in the lower wall have been supplanted by solid sheets of steel. All of the outside walls in the leanto section are faced on the interior with glazed tile to ceiling height

The piping, bus duct, and conduit shown here is typical of the installation throughout the plant, where the use of packed wood and maple flooring to support the manufacturing area overhead makes it a simple matter to connect manufacturing equipment to any of the required service lines. Installation crews simply bore holes in the floor from above at specified locations, and the extensions required to connect machinery to particular services are then made from below. By providing distributing lines for compressed air, illuminating gas, oxygen, hydrogen, nitrogen, steam, and water in every bay, the maximum pipe runs required to connect individual machines have been held to a few feet. Piping for each of these services is identified by distinctive color and is supported by hangers attached directly to the steel floor beams. Distribution lines, which are arranged in four distinct banks, extend across the building from east to west

This compact concentration of service facilities on the sloping hillside at the rear of the plant reflects effective utilization of natural grades in laying out the 50 acre site. The two story and mezzanine boiler house has three 300 hp oil fired boilers each capable of generating 20,000 lb per hr of steam. Footings have been installed for a fourth boiler, and all have been designed for ready conversion to coal. The three 770 ton centrifugal refrigerating compressors in the boiler house and the 7000 gpm cooling tower, shown on the right, provide refrigeration for all portions of the 380,000 sq ft of air conditioned space in the two story plant and the adjacent office building. The towers are supported on the walls and roof of a 150,000 gal capacity reinforced concrete fire protection tank. Process waste is treated in the 50,000 gal reinforced concrete acid diffusion basin shown here adjoining the pump house in the foreground. The basin and an 8000 gal pump basin are lined with acidproof brick. A portion of the main power transformer station, equipped with two double winding 5000 kva, three phase transformers can be seen on the extreme left, while air vents from the extensive fuel oil tank storage facilities can be seen between it and the boiler house



mopped on both sides with a vapor seal to eliminate possibility of moisture transfer. They have 4 in. of buff face brick, backed by 4 in. of common brick on the exterior, and 4 in. of ceramic glazed tile inside, and wall ties of 3/16 in. steel rods extending horizontally through the full thickness of the wall at every fourth course (or 10½ in. apart).

The 2 ft, 9 in. vision strip in the 25 ft leanto section, which extends around the perimeter of the main floor, is double glass, with a dehydrated air space between the panes, set in fixed architectural sash of steel.

The welded steel roof decks of manufacturing and office buildings are covered with 2 in. of rigid foam glass insulation laid on a two ply vapor seal and topped by four ply asphalt and slag waterproofing.

The wide range of lighting requirements throughout the production departments has been effectively met by the installation of individual bench lamps and integral machine lighting, which supplement semicontinuous, recessed fluorescent troffer lighting on 12 or 13 ft centers in the suspended metal acoustic ceiling, 18 ft above the main floor. This maintains a general lighting level of 45 foot-candles.

Mezzanine One Vast Plenum Chamber

All of the air conditioning equipment for the main floor is located in the huge mezzanine, which extends through the 100 ft welded steel roof trusses over the central portion of the plant and serves as one vast plenum chamber. Six identical units, evenly distributed over the central portion, serve the general manufacturing area, while four similar units, located in the four corners of the mezzanine, meet the highly diverse needs of the individual rooms around the perimeter through four double duct air conditioning systems, with separate sets of thermostatic damper controls for the individual rooms.

The reinforced concrete mezzanine floor slabs along the east and west sides were made especially wide (12 ft) to facilitate the installation of special ventilating fans and auxiliary cooling units, needed to satisfy the special requirements of processing departments located in the leantos on these sides.

Four additional air conditioning units have been located along the north and south walls on the lower floor, which is served directly by an independent system of air conditioning ducts.

The ground floor area is likewise illuminated by semicontinuous fluorescent lighting units to a general level of 25 foot-candles. These are mounted at a height of 14 ft. Much of this area is devoted to toolroom and other metal working operations in connection with metal parts production; to photo and chemical laboratories, and to storage of glass, production parts, packaging materials, and finished merchandise.

A space along the north and south walls accommodates safety stores, training work shop, locker rooms, lavatories and offices, as well as the four lower level air conditioning rooms, while that along the east and west walls houses the grinding, welding, sand blasting, and similar operations which present special ventilating problems.

A two story and part basement office building 75 ft by 225 ft, with 75 ft clear span trusses throughout the second floor engineering department, occupies the most prominent position on the rolling site, facing Union Blvd. (Route 22), which is the connecting link between Allentown on the west and Bethlehem on the east. It is connected to the main manufacturing floor of the plant by a covered passage.

Glazed tile was used throughout all the general areas in the office building, which has suspended metal acoustic ceilings with recessed fluorescent troffer lighting and asphalt tile flooring. Private offices have plastered walls painted in light muted shades to complement the natural lighting.

Employment offices and the plant's medical department are also located in the office building but are served by individual entrances which facilitate the segregation of traffic to these points and the other offices.

Parking facilities for 600 employee cars and 30 visitor cars are paved with blacktop and are conveniently located along the east side of the plant and office.

40 Miles of Process Piping

The overall project also includes a large boiler house with two narrow bands of continuous horizontal sash completely surrounding it, a battery of three large cooling towers which are supported by a 150,000 gal reinforced concrete fire protection tank, and a steel frame gas generator building directly adjacent to the tank farm where holders for the storage of nitrogen, hydrogen, and oxygen produced in this building are located.

A most unusual feature of the project as a whole is the vast piping installation, which includes approximately 40 miles of pipe ranging from ½ to 6 in. in diameter for processes alone.

Many features are included in the new plant to give it an edge on Father Time's twin brother, "obsolescence"

ACRMA REVISES REFRIGERANT MANUAL

Properties of Commonly-Used Refrigerants, a manual first published in 1946, is now available in a revised 1948 edition, according to an announcement by the Air Conditioning and Refrigerating Machinery Association, Southern Bldg., Washington, D. C.

In the 1948 edition of this authoritative publication, ACRMA presents new tabular data and charts showing the thermodynamic properties of ammonia below minus 60 F; new pressure-enthalpy diagrams for "Freon-11", "Freon-12", and "Freon-22", showing data for a greater range of conditions; new tabular data for "Freon-12" covering the temperature range from 140 F to 232.7 F, and for "Freon-22" covering the temperature range from 120 F to 160 F.

This 105 page publication sells for $1.

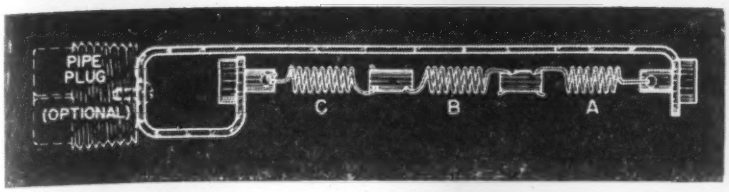


Fig. 1—The NDHA corrosion tester comprises three helical coil specimens electrically insulated from each other and the supporting frame. The pipe plug normally is used only when tester is installed in a pipe

THE NDHA CORROSION TESTER
How It Performs in Use

By Leo F. Collins

THEORISTS INVARIABLY inquire as to the agreement exhibited by the three helical coils of the NDHA corrosion tester, Fig. 1, or question the need for using multiple coils. Those with little experience in field testing are given to indicting the installation techniques as superfluous. Both like to speculate as to the decelerating effects of accumulated corrosion products, the accelerating effects of cold working of the metal in winding the coils, and the reproducibility of results.

The data in Table 1 attest the agreement shown by coils of the same material when the installation techniques outlined in the October HPAC were used.

Need for Three Helical Coils

Even though an approved installation technique is used, there is always a possibility that "things will happen." In Table 2, data are presented which disclose that through the use of three coils, serious errors were avoided. In two cases, one coil was shielded; obviously, therefore, it could not reflect a true corrosion rate. In the third instance, the objective of the test was to measure the rate of attack in an intermittently operated line. Clearly, therefore, only the value from coil "A" could be accepted.

In view of the data shown in Tables 1 and 2, it is clear that when good agreement is obtained between the coils, average values should be accepted [values are usually reported to the nearest whole number for reasons explained later under "Significance of Measured Values"]. Where explainable descrepancies occur, the most probable rather than the average value should be taken.

The data in Table 3 attest the magnitude of the errors that may ensue if testers are not properly situated. It was these data that prompted the development of the pipe loops shown in Figs. 5 and 6 of the October article.

Influence of Accumulated Corrosion Products

In Fig. 2 is shown the results of studies wherein coiled and uncoiled steel wire specimens were used to discover the possible effects of accumulating corrosion products. From these data it is clear that, where insoluble products are formed, there is some mechanical trapping of such products by the coiled specimens. Where serious corrosion occurs, insoluble products which act protectively seldom, if ever, are formed.

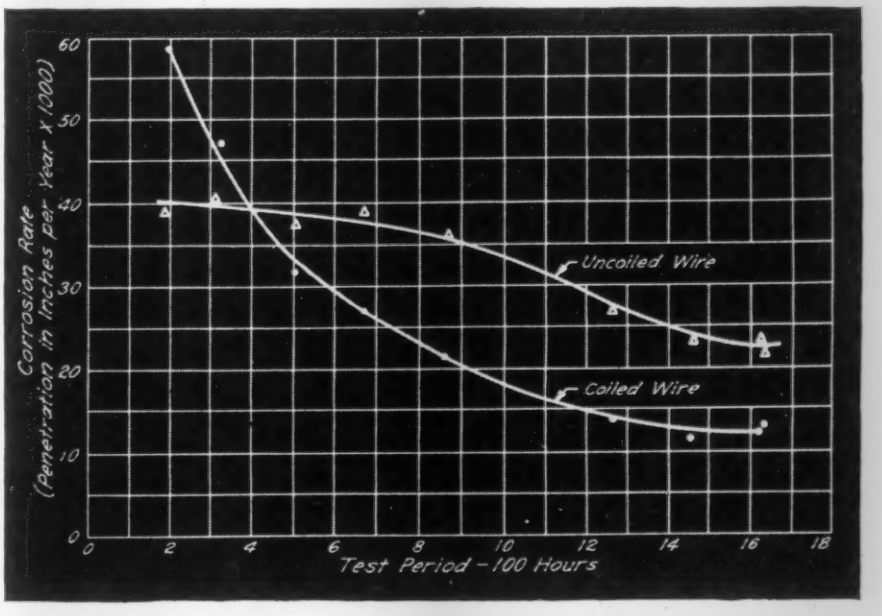
Clearly, when the object of the test is to measure maximum corrosivity, a unit should be exposed not to exceed five days. When the object is to measure average conditions, the curve attests that after a 30-day period there is a negligible increase in the effectiveness of the accumulated products.

Attesting this latter point are the results shown in Table 4.

Effects of Cold Working of Metals

In Figs. 3 and 4 are shown graphically the results obtained when coiled and uncoiled wires of various metallic compositions were kept in

Fig. 2—Protective influence of corrosion products formed on specimens is indicated here



Copyright, 1948, by Leo F. Collins.

Table 1—Agreement exhibited between coils of same material when testers were installed as recommended. (Corrosion rates are shown as average penetration in inches per year times 1000)

Metal in coils	Test locations	Corrosion rates shown by coils A	B	C	Avg.
Metal "A"	Drip line—140 psig steam main	0.7	0.8	0.7	0.7
Metal "A"	Drip line— 20 psig steam main	4	3	5	4
Metal "A"	Drip line— 2 psig steam main	8	6	9	7
Metal "A"	Drip line— 6 Hg vac. steam main	11	11	10	11
Metal "A"	Dry return line—pressure system	10	11	11	11
Metal "A"	Dry return line—vacuum system	17	14	15	15
Metal "A"	Return line—valet machine	2	3	2	2
Metal "A"	Return line—unit heater	17	16	16	16
Metal "A"	Return line—water heater	24	20	19	20
Metal "A"	Drain line—vent condenser—deaerating heater*	13	12	—	13
Metal "B"	Drain line—vent condenser—deaerating heater*	None	None	—	None
Metal "D"	Drain line—vent condenser—deaerating heater*	12	11	—	12
Metal "E"	Drain line—vent condenser—deaerating heater*	11	12	—	12
Metal "B"	Underground steam line conduit—ground water	0	0	0	0
Metal "C"	Underground steam line conduit—ground water	0	0	0	0
Metal "D"	Underground steam line conduit—ground water	4	4	4	4
Metal "E"	Underground steam line conduit—ground water				
Metal "F"	Underground steam line conduit—ground water	3	3	3	3
Metal "G"	Underground steam line conduit—ground water	0.2	0.5	0.3	0.3
Metal "H"	Underground steam line conduit—ground water	0.9	0.5	0.3	0.5
Metal "A"	Standard salt spray	8	8	8	8
Metal "D"	Standard salt spray	1	2	1	1
Metal "F"	Standard salt spray	1	2	2	2
Metal "H"	Standard salt spray	0.3	0.5	0.3	0.4

* In these studies, two large coils in lieu of three small coils were used.

Table 2—Data attesting the advisability of using multiple test specimens. (Corrosion rates are shown as average penetration in inches per year times 1000)

Test locations	Corrosion rates shown by coils A	B	C	Avg.
Bottom vertical return line—unit heater	16	16	9*	16
Inserted vertically through bottom cast iron radiator	27	24	7*	26
Inserted vertically in one leg of "U-seal"	6†	15	15	6

* These coils found covered with accumulated corrosion products.

† Object of test was to determine rate of corrosion where condensate flowed intermittently. Inadvertently, a pressure change occurred during test period which kept coils "B" and "C" always submerged.

Table 3—Data showing magnitude of errors resulting from faulty installation techniques. (Corrosion rates are shown as average penetration in inches per year times 1000)

Test locations	Corrosion rates measured under: Demonstrated technique	Faulty technique
Drip line—steam main	8	0.3
Return line—pressure heating system	19	1.4
Return line—cafe steam table	11	0.6
Return line—water heater	5	0.9

Table 4—Data attesting adequacy of 30 day test period. (All data are for average conditions. Corrosion rates are average penetration in inches per year times 1000)

Test period—28 days Control factors* Temp., F	Oxygen ppm	pH Value	Corrosion rate	Test period—49 days Corrosion rate	Control factors pH Value	Oxygen ppm	Temp., F
207	0.0	5.9	4	5	5.9	0.0	212
97	0.4	5.8	8	8	5.8	0.3	197
126	3.0	5.5	6	6	5.5	3.0	134
144	—	5.7	15	17	5.7	2.1	144
83	4.1	6.0	12	10	6.0	5.4	91
83	5.5	5.1	18	18	5.1	6.1	72
109	4.4	5.1	25	26	5.1	5.1	83

* Steam condensate the corroding medium.

Table 5—Data attesting reproducibility of results at scattered test periods in condensate. Both measurements made at same location at about same calendar periods. Test period, 49 days. (Corrosion rates shown as average penetration in inches per year times 1000)

Test locations	Corrosion rates measured First year	Second year
One pipe steam heating system	5	5
Return line—vacuum heating system	9	9
Return line—gravity heating system	11	15
Return line—blast coils	14	11
Mixed returns—radiators and unit heaters	21	17
Wet return—pressure system	21	21

contact with flowing condensate and hot Detroit city water, respectively, for different test periods. These data show clearly that cold working does decrease the corrosion resistance of metals susceptible to attack provided the products of corrosion do not act protectively. It will be shown later, however, that this accelerating effect serves to improve the utility of the tester.

Reproducibility of Results

It is felt that the data in Table 4 and in Figs. 3 and 4 disclose the reproducibility to be expected when measurements are made during consecutive time periods. It is possible, too, to demonstrate the reproducibility obtainable when measurements are made at widely separated test periods.

Steam Condensate Systems—The data in Table 5 were obtained at the same locations, but the time between test periods was about one year.

Underground Steam Line Atmospheric Tests—In Table 6 are shown the results obtained at the same location in an underground steam system atmospheric survey. The time periods between measurements was also about one year.

Boiler Feedwater Treating System—The data shown in Table 7 were obtained at two stations, during an interval of about 10 years.

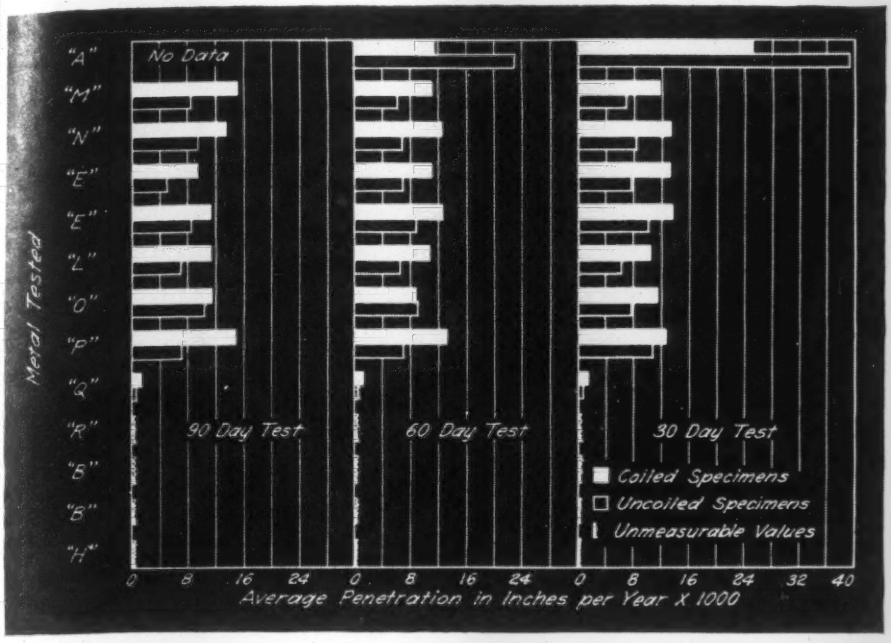


Fig. 3—Comparative corrosion resistivity of 10 materials subjected to condensate from the vent condenser of a deaerating feedwater heater

Significance of Measured Values

In the technical literature, corrosion rates are reported in many different "systems of units." However, two are most frequently used; they are milligrams per square decimeter per day, and average penetration in inches per year. Outside the chemical field, the latter seems to be preferred by engineers—especially if the results are multiplied by 1000 so that only whole numbers are involved. It is for these reasons that all the values shown in this article are reported in such units.

When using such a system of units, experience indicates that values up to 10 represent negligible corrosion, values between 10 and 20 a mild rate of attack, and values over 20 a condition that likely will create important troubles. Much, of course, depends upon the wall thickness of the pipe or tank in question.

Since—in reporting corrosion rates—uniform penetration is assumed, and because it is well known that pitting causes failures more quickly than does generalized attack, some critics claim there is virtually no chance of correlating equipment life and corrosion rate as measured by the tester.

Correlation Between Measured Values and Equipment Life

The data in Figs. 3 and 4 show that attack is accelerated due to cold working of the metal in winding the coils. A study of the characteristics of flow of liquids over confining surfaces indicates that the scouring action upon the surface of the helical coils is considerably more than on the surface of the container. Apparently these accelerating factors about cancel the increased rate of attack which occurs when pitting rather than generalized attack occurs. Thus, measured values correlate well with actual "life values." Attesting this are the data in Table 8.

Appraisal of Corrosion Inhibitors

In Fig. 5 is shown the results obtained when a very corrosive condensate, "inhibited" and "uninhibited," was caused to flow over specimens. The inhibitor was a solid

Fig. 4—Comparative corrosion resistivity of materials exposed to hot hard water

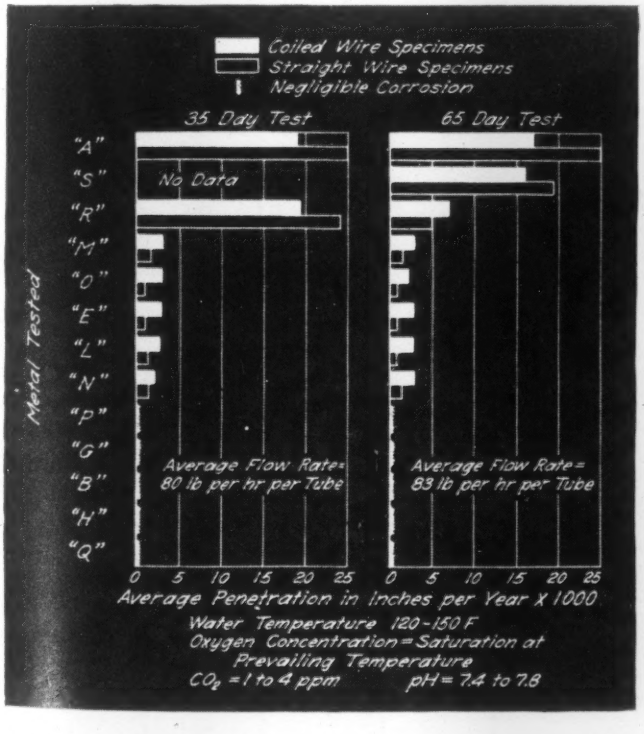
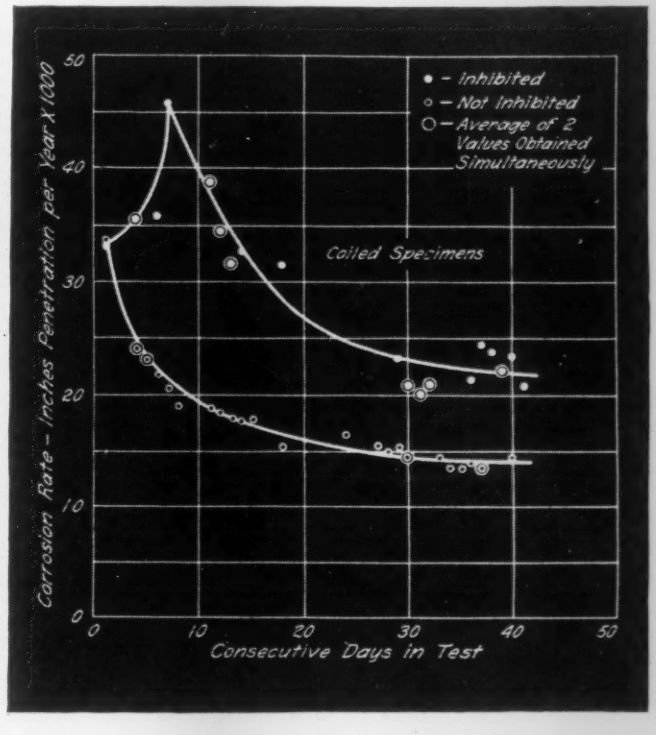


Fig. 5—Measurements showing ineffectiveness of a particular corrosion inhibitor in a certain set of circumstances


• – Inhibited
○ – Not Inhibited
○ – Average of 2 Values Obtained Simultaneously
Coiled Specimens
Corrosion Rate – Inches Penetration per Year X 1000
0 10 20 30 40 50
0 10 20 30 40 50
Consecutive Days in Test

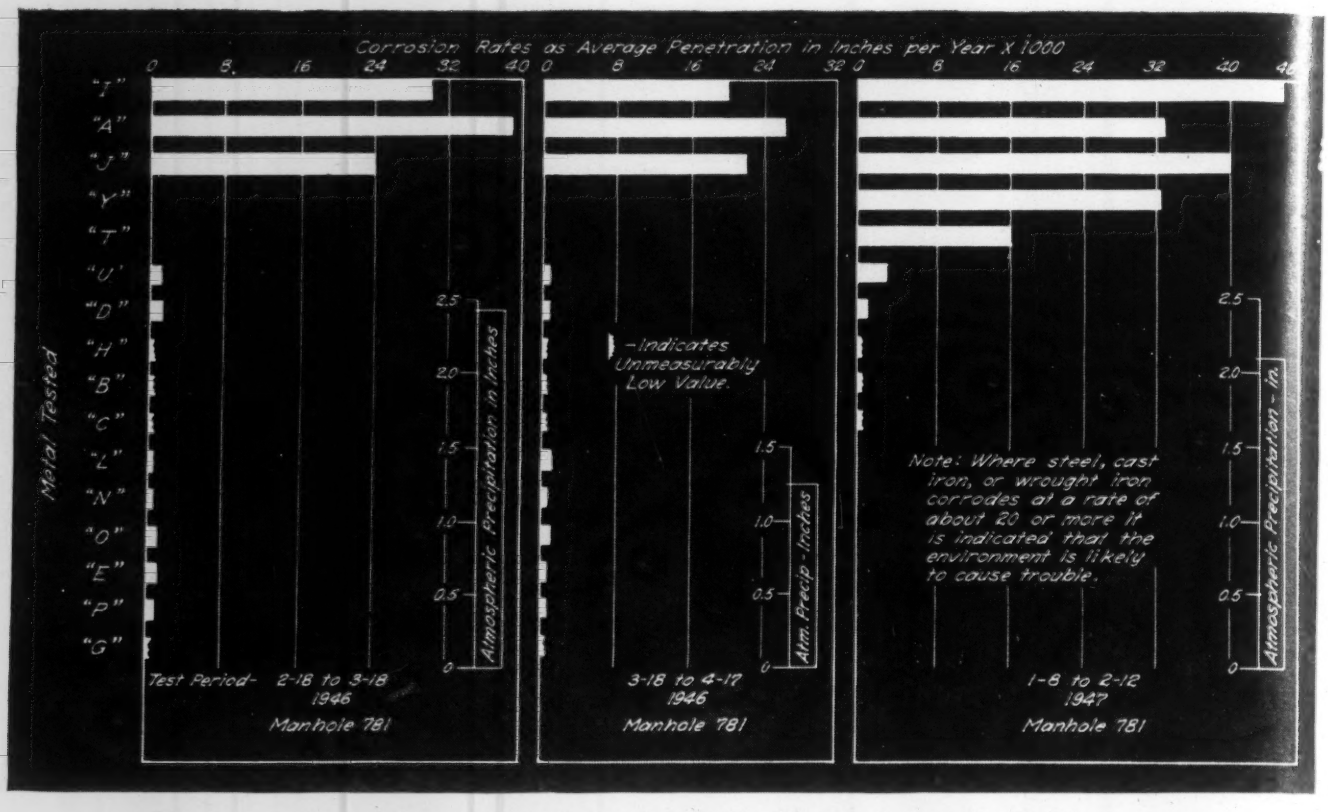


Fig. 6—Corrosion rates measured in "atmosphere" of underground steam distribution system

whose properties were represented as: ". . . . initially it will dissolve quite rapidly until the system has been brought to equilibrium. After a film has formed on its surface it will dissolve slowly, thus keeping the system conditioned over a long period." Clearly, the tester did not substantiate such a contention.

In Table 9 are shown data typifying the findings at the Bureau of Mines to evaluate the corrosion inhibiting power of amines fed to steam, as reported by A. A. Berk in Industry and Power, November 1947.

Atmospheric Corrosion in Underground Steam System

In an underground steam system which was the subject of an atmospheric corrosion study, the steam lines are housed in a concrete envelope. The objective of the survey was twofold: To determine if the water which finds its way into the concrete envelopes (and is the basic cause of corrosion) is derived primarily from precipitation (rain, snow, etc.) or from leaking water and sewer mains; and to discover a metal that would be virtually immune to attack and otherwise usable.

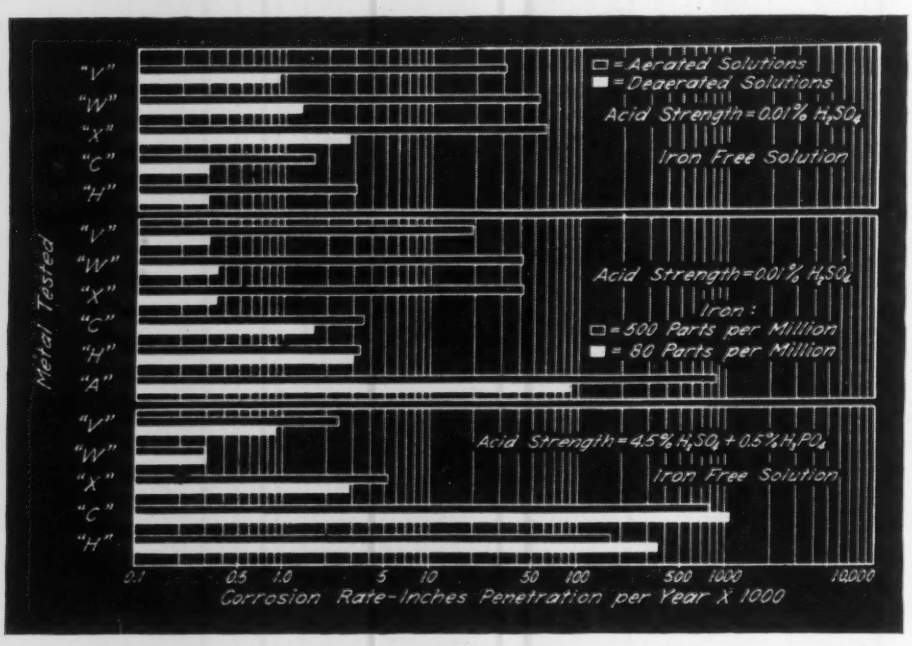
Data typifying the findings are shown graphically in Fig. 6.

Corrosivity of Sodium Chloride Solutions

Because of a decision to use stainless steel pipe supports in this steam distribution system, tests were made of two stainless steels and other metals by subjecting testers to a standard salt spray test, ASTM designation B117-44T, and by submerging them in an industrial salt brine saturator. These results are shown in Table 10.

In another series of tests, the objective was to determine a metal that would satisfactorily withstand attack by aerated and deaerated sulphuric acid solutions at a temperature slightly above the atmospheric boiling point. The results obtained are shown in Fig. 7.

Fig. 7—Corrosion rates measured in boiling dilute acid solutions



What Corrosion Tester Can Do

It is believed that the foregoing presentation attests that the corrosion tester:

Table 6—Data attesting reproducibility of results at different periods in underground steam line tests. Test period "A", 2/18/46 to 3/18/46. Test period "B", 1/18/47 to 2/12/47. Measurements made at same location. (Corrosion rates shown as average penetration in inches per year times 1000)

Metals involved	Corrosion rates measured "A"	"B"
Metal "I"*	29	46
Metal "J"*	30	40
Metal "A"	32	33
Metal "D"	1.0	0.6
Metal "F"	1.5	1.6
Metal "B"	0	0
Metal "C"	0	0
Metal "H"	0	0

*Strip specimens used.

Table 7—Data from surveys of boiler feedwater treating systems. (Corrosion rates shown as average penetration in inches per year times 1000)

Key points	Corrosion rates measured: Same plant, Different systems: Old*	New†	Different plants, Same system†: "A"	"B"**
Raw water	2	2	2	4
Softener effluent	—	18	18	14
Receiver††	38	31	29	29
Heater effluent	90§	1	3	8
Boiler water	8	—	—	—

*Hard water fed direct to open heater.
†Zeolite softened—acid treated and deaerated water.
**Measured with cast iron strip specimens.
††Contains mixture of makeup water and return condensate.
§Undeaerated water.

Table 8—Data attesting the correlation of actual equipment life and that predicted by corrosion testers. (Corrosion rates are shown as average penetration in inches per year times 1000)

Metal involved	Measured corrosion rates	Wall thickness, In.	Life, years: Predicted	Actual	Type of service
Metal "G"	13	0.049	3.8	4	Vent condenser tube—deaerator
Metal "E"	11	0.049	4.5	7	Vent condenser tube—deaerator
Metal "L"	11	0.049	4.5	5	Vent condenser tube—deaerator
Metal "K"	18	0.280	16	11	Effluent line zeolite softener*
Metal "K"	29	0.375	13	17	Storage tank—soft water and condensate

*Failure in imperfect butt weld.

Table 9—Corrosion inhibitor test. (Corrosion rates shown as average penetration in inches per year times 1000)

Corrosion rates: Uninhibited condensate	Inhibited* condensate	Condensate temp., F
54	3	287
37	12	228
30	15	212

*With amines.

Table 10—Corrosivity of brine solutions at room temperature. "A", ASTM standard salt spray test; "B" immersed in saturated NaCl solution. (Corrosion rates shown as average penetration in inches per year times 1000)

Metals involved	Corrosion rates measured "A"	"B"
Metal "I"*	10.0	1.9
Metal "J"*	10.0	2.2
Metal "A"	8.1	1.2
Metal "D"	1.4	1.4
Metal "F"	1.4	0.8
Metal "B"	0.1	0.1
Metal "C"	0.2	0.7
Metal "H"	0.4	0.4

*Strip specimens used.

1) Gives reliable results in far less time than any other known method of corrosion measurement, i.e., 30 days or less.

2) "Checks" its own findings when coils of identical composition are used.

3) Does not require the making of complementary measurements unless the causes for corrosion are to be explained.

4) Can be manipulated in the field without special tools or skills.

5) May be employed to measure the corrosivity of any medium wherein the temperature does not exceed about 400 F, and where rates of flow (of liquids) do not exceed 5 fps.

To date, the Detroit Edison Co. has attempted not only to produce testers as requested, but also to serve as a clearing house for the data collected. It has long been recognized, however, that such services could not logically be continued indefinitely. Accordingly, an arrangement has been reached whereby testers and complementary services will be made available, hereafter, through the Water Doctor Laboratories, 14-615 Prevost Ave., Detroit 27, Mich.

Check Ventilation Needs of Unfamiliar Solvents

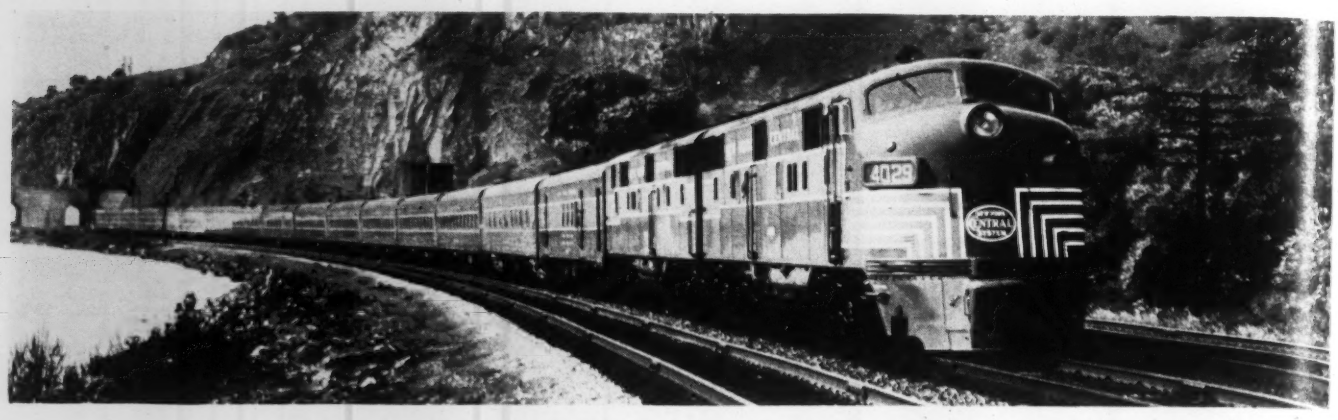
When a solvent that is new to a plant or shop is introduced, any hazards involved should be fully understood by everyone concerned. Otherwise an accident may result, since improper handling or inadequate precautions may lead to illness or fire or both, the Safety Research Institute points out.

An accident occurred in a plant not long ago when a group of men were assigned to work in a pit under a punch press, using as a lubricant or coolant during tapping a nonflammable solvent which was new to the company. Because the solvent container was labeled with a warning to the effect that ventilation should be provided, some air was forced into the pit by means of an air hose. No one realized, however, that it was necessary to assure that this would provide sufficient ventilation in terms of the amount of solvent used and the type of place in which the men were working.

The men worked all day without complaint, all but one stopping from time to time, "to come up for air." At the end of the day, two men became ill and one of them, the man who had worked with no interruption throughout the day, died a few days later.

In another plant, employees were given a new paint for use on machinery but were unaware that the solvent in the paint was highly flammable, although the label warned that the material should be kept away from flames. The men applied the paint while a welding operation was going on nearby, and a serious explosion followed.

If the label on an unfamiliar solvent carries warning statements which are not fully understood, detailed information on properties and necessary precautions to be observed should be obtained from the manufacturer before the product is put to use. In many states and cities, such information is also available from the industrial hygiene division of the health or labor department.



Normal "consist" of the new Twentieth Century Limited is 16 cars pulled by a double unit, 4000 hp, diesel-electric locomotive. Air conditioning systems for the dining, kitchen, lounge, and observation cars have capacities of about 7 tons. Sleeping car system capacities are 6 tons

Air Conditioned Luxury Travel Featured by Twentieth Century

Seven Ton and Six Ton Systems Serve Individual Cars

A "NEW NOTE in luxury travel and passenger comfort" has been sounded by the New York Central railroad with a new Twentieth Century passenger service inaugurated between New York and Chicago. The 16 car train is packed with almost every imaginable convenience and comfort making device—from the huge 4000 hp diesel-electric locomotive to the tip of the smart observation car in the rear.

From the very first, designers and engineers assumed that passenger comfort hinged about a few basic human desires. Proper room temperatures had to be considered. The air that the traveler was to breathe should be clean and fresh. Air humidity should be just right to prevent discomfort. Refrigeration facilities, adequate to protect a wide variety of food and thus make possible the serving of tempting meals as well as long, cool drinks, were a "must." Because of these basic "wants", initial planning called for air conditioning and refrigeration on a scale comparable to systems found in large, modern hotels, according to engineers of the Frigidaire Div. of General Motors.

Dining, kitchen, lounge, and observation car air conditioning systems have a capacity of about 7 tons each while 6 tons of capacity is employed in each sleeping car. Separate air conditioning systems are incorporated into individual cars, including a compressor-motor unit and controls, condenser, and air conditioning unit.

The compact, rugged compressor-motor unit is specially engineered for railway car use. It is mounted under the car in a position convenient for servicing and maintenance. Power for the 12 hp ball bearing motor is supplied by an axle driven generator. The motor has a special pivot type mounting to simplify belt adjustment or replacement. The unit also has oversized bearings, full pressure lubrication, and heavy duty valves. Neoprene head gaskets eliminate the need for tightening head bolts at regular intervals. All controls are grouped on a single panel, which is located in a convenient locker in the car itself.

A dry type condenser is part of the air conditioning system. It is equipped with two condenser coils that speed up the transfer of heat from the refrigerant to cooling air. Closely spaced copper fins afford a large heat transfer surface. Two 18 in. fans, driven by a 1 hp motor, cool the condenser coils.

The air conditioning unit which cools the air is concealed in the top of the car. It is connected to an overhead distribution duct that circulates dehumidified, filtered, and cooled air. Uniform cooling is assured by multipath distribution headers, which meter an equal amount of refrigerant to each of eight parallel passages through the cooling unit. The capacity is increased by a counterflow principle. Faster heat transfer is afforded by a staggered tube arrangement.

Modulated cooling is provided by dividing the cooling unit into two sections, each with its own expan-

tion valve and distribution header. When reduced cooling is required, an electrically controlled valve automatically shuts off the flow of the refrigerant to the upper section of the unit. At the same time the compressor-motor unit output is reduced to balance the cooling load. This arrangement provides an intermediate capacity and eliminates sharp temperature changes, regardless of the conditions outside.

Air is circulated by two centrifugal blowers powered by a 1 hp motor. A heating coil is available for wintertime use.

Like any other modern hotel catering to a wide and varied guest clientele, the best in food and drink is a standard requirement of the Century's hungry and thirsty guests.

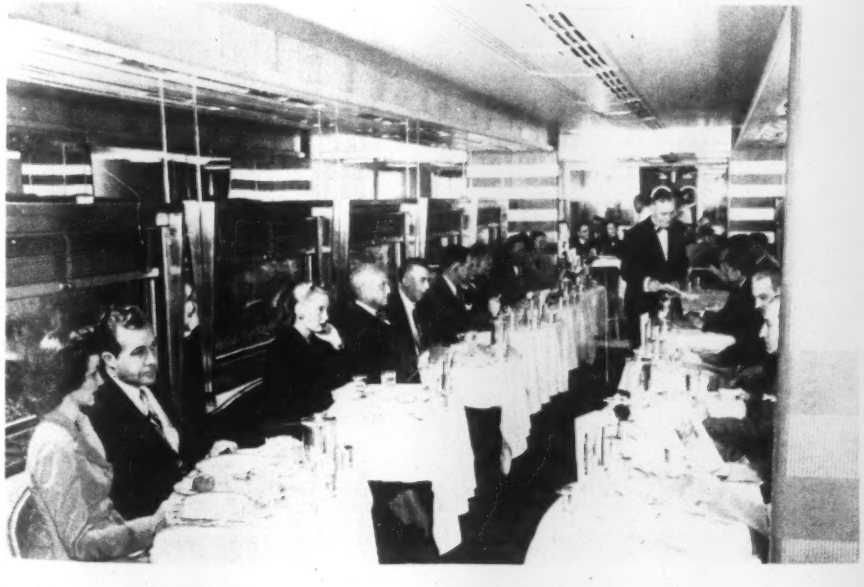
Consequently, the gleaming stainless steel kitchen car is equipped with an assortment of modern appliances, supplying every requirement of the chef. Electric-eye devices automatically open doors for waiters with loaded trays.

Three 1 hp reciprocating condensing units refrigerate a combination provision chest for storing meats, fish, poultry, ice cream, frozen food and ice cubes; a beverage and fruit cabinet; and a milk and cheese storage box. The capacity of these condensing units is stepped up by a valve-in-head arrangement. The combination provision chest is equipped with an evaporator coil in the top plus a plate for contact freezing below. Two ice makers are installed in the fruit and beverage chest, while a single evaporator coil cools the dairy product storage box.

The diner is full-length and has accommodations for 64 persons. It is divided into five separate sections. In one end of the car is an additional dining space and cocktail lounge, equipped with a fruit and beverage cooler.

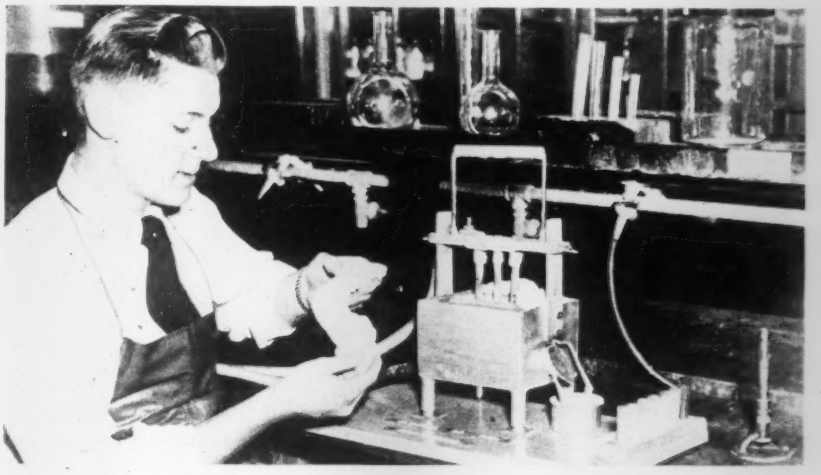
Both the barber-secretarial-lounge car and the bedroom-lounge-observation car are equipped with service bars for the convenience of passengers. One-third and 1 hp condensing units supply refrigeration. The barber-lounge car bar contains an evaporator coil while the ice freezing and beverage box in the lounge-observation car has two ice making evaporators.

Pullman-Standard Car Mfg. Co., Chicago, built the new Twentieth Century cars.



The full-length diner on the new Century seats 64 persons. The kitchen is in a separate car, which also has sleeping accommodations for the train crew. Standing at right in this photo is Tommy Walsh, famous Century steward

Student Builds Model of Reduction Cell



Stanley Sitta, high school student, won two special awards for this working model of a reduction cell which actually produces aluminum

That aluminum has fired the imagination of high school students is evidenced by a project of Stanley Sitta, who recently was graduated with two special merit awards from Morton high school, Cicero, Ill. The project is a working model of Martin Hall's original reduction cell and is able to produce small buttons of pure aluminum. The model was awarded top prize in a state science exhibit at Benton, Ill.

It consists of a welded steel shell lined with carbon to simulate the Hall electrolytic cell. Heavy carbon rods are used as expendable electrodes and they are bolted in a busbar in such a way that, as they become consumed, they can be lowered into the electrolytic cell. The source of the current for the operation of the cell is an arc welding generator with a capacity of about 500 amp. For operation of the cell, the same materials are used as in commercial practice . . . alumina, cryolite, and metallic fluorides.

The cell is operated at 5-7 volts for several hours and at the end of this time, numerous small pellets of pure aluminum are obtained. Necessarily, the working model was made with considerable care and is operated under a rigidly balanced formula.

DATA SHEET

Average Monthly and Seasonal Degree Days

AVERAGE MONTHLY and seasonal degree days to the 65 F base have been calculated by the Weather Bureau, U. S. Department of Commerce, and are presented here.

For the computations, the daily mean temperatures (not monthly means) were used for all stations and for the whole period as stated in the tabulation. No approximations to arrive at degree day figures were used. In other words, the daily mean temperature observations for each calendar day for the indicated period of record were converted to degree days; then, monthly and seasonal totals and averages were calculated.

A monthly bulletin on degree days is available without charge from the Weather Bureau. This is issued during the first few days of each month, and covers degree day observations of the preceding month at approximately 200 stations. Requests for this bulletin should be addressed to the Chief, U. S. Weather Bureau, Washington 25, D. C. Att: Division of Climatological and Hydrologic Services.

State and Station	Years	No. of Seasons	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Season Total
ALABAMA															
Anniston	1905/06-1940/41	36	0	0	10	135	388	600	609	513	361	152	37	1	2806
Birmingham	1898/99-1945/46	48	0	1	10	111	348	586	591	497	313	130	23	1	2611
Mobile	1898/99-1945/46	48	0	0	1	44	203	377	397	314	175	52	3	0	1566
Montgomery	1898/99-1945/46	48	0	0	4	71	279	484	494	405	239	85	10	0	2071
ARIZONA															
Flagstaff	1898/99-1940/41	43	43	70	244	573	847	1111	1167	970	889	668	469	190	7241
Phoenix	1898/99-1945/46	48	0	0	0	18	166	384	402	263	154	47	7	0	1441
Yuma	1898/99-1940/41 & 1945/46	44	0	0	0	9	113	306	318	182	85	22	1	0	1036
ARKANSAS															
Bentonville	1906/07-1940/41	35	1	1	38	216	516	810	879	716	519	247	86	7	4036
Fort Smith	1898/99-1945/46	48	0	0	12	128	410	717	763	615	390	154	36	1	3226
Little Rock	1898/99-1945/46	48	0	0	11	120	383	668	704	579	367	145	31	1	3009
CALIFORNIA															
Eureka	1898/99-1945/46	48	281	269	274	344	411	518	541	478	504	440	391	307	4758
Fresno	1898/99-1945/46	48	0	0	5	77	309	562	573	380	289	152	52	4	2403
Independence	1898/99-1940/41	43	0	0	28	216	512	778	799	619	477	267	120	18	3834
Los Angeles	1898/99-1945/46	48	1	0	5	43	110	225	272	235	212	158	103	27	1391
Needles	1917/18-1938/39	22	0	0	0	19	217	416	447	243	124	26	3	0	1495
Point Reyes	1898/99-1940/41	43	350	336	263	282	317	425	467	406	437	413	415	363	4474
Red Bluff	1898/99-1933/34, 1938/39-1940/41, & 1944/45-1945/46	41	0	0	12	97	345	592	601	419	328	178	72	9	2653
Sacramento	1898/99-1945/46	48	2	1	15	98	332	582	595	405	326	202	101	21	2680
San Diego	1898/99-1945/46	48	5	1	9	60	143	252	300	257	230	172	118	49	1596
San Francisco	1898/99-1945/46	48	196	179	121	139	241	420	460	340	317	272	255	197	3137
San Jose	1906/07-1940/41	35	21	21	52	151	329	512	527	383	339	249	167	72	2823
COLORADO															
Denver	1898/99-1945/46	48	8	8	126	411	716	1005	1023	897	790	516	275	64	5839
Durango	1904/05-1940/41	37	25	37	201	535	861	1204	1271	1002	859	615	394	139	7143
Grand Junction	1898/99-1945/46	48	1	1	59	347	743	1138	1218	883	671	377	152	23	5613
Leadville	1907/08-1940/41	34	280	332	509	841	1139	1413	1470	1285	1245	990	740	434	10678
Pueblo	1898/99-1945/46	48	3	4	91	377	730	1042	1042	875	724	446	195	29	5558
CONNECTICUT															
Hartford	1904/05-1945/46	42	3	16	105	370	692	1065	1157	1062	859	524	213	47	6113
New Haven	1898/99-1945/46	48	3	11	88	341	658	1017	1109	1023	840	522	221	47	5880
DIST. OF COLUMBIA															
Washington	1898/99-1945/46	48	0	2	42	251	553	872	928	834	624	340	101	14	4561
FLORIDA															
Apalachicola	1913/14-1945/46	33	0	0	1	23	154	300	323	252	159	38	2	0	1252
Jacksonville	1898/99-1945/46	48	0	0	0	25	144	294	302	244	131	42	3	0	1185
Key West	1898/99-1945/46	48	0	0	0	0	2	14	21	15	7	0	0	0	59
Miami	1911/12-1945/46	35	0	0	0	0	15	41	53	45	28	3	0	0	185
Pensacola	1913/14-1945/46	33	0	0	0	25	159	305	332	255	162	39	4	0	1281
Tampa	1898/99-1945/46	48	0	0	0	6	60	149	157	126	62	11	0	0	571
GEORGIA															
Atlanta	1898/99-1945/46	48	0	0	12	128	392	644	660	563	382	169	33	2	2985
Augusta	1898/99-1945/46	48	0	0	4	85	312	529	533	448	274	107	13	1	2306
Macon	1899/1900-1945/46	47	0	0	5	91	322	532	538	449	278	168	14	1	2338
Savannah	1898/99-1945/46	48	0	0	1	45	206	390	395	332	194	66	6	0	1635
Thomasville	1905/06-1940/41	36	0	0	2	48	208	361	359	299	178	52	5	1	1513

State and Station	Years	No. of Seasons	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Season Total
IDAHO															
Boise	1898/99-1945/46	48	9	17	136	385	717	1025	1077	840	688	440	252	92	5678
Lewistown	1900/01-1932/33	33	5	9	107	378	688	932	992	779	603	371	193	52	5109
Pocatello	1898/99-1945/46	48	12	21	176	475	821	1159	1224	1004	845	550	330	124	6741
ILLINOIS															
Cairo	1898/99-1945/46	48	0	0	26	181	493	823	878	748	512	232	60	4	3957
Chicago	1898/99-1945/46	48	6	7	88	337	712	1116	1218	1080	861	531	259	67	6282
Peoria	1905/06-1945/46	41	4	8	88	350	730	1126	1231	1035	790	436	178	28	6004
Springfield	1898/99-1945/46	48	0	3	65	286	664	1056	1151	977	719	377	132	16	5446
INDIANA															
Evansville	1898/99-1945/46	48	0	1	35	211	544	888	948	822	582	288	85	6	4410
Fort Wayne	1911/12-1945/46	35	6	13	106	374	737	1107	1211	1652	864	504	217	41	6232
Indianapolis	1898/99-1945/46	48	1	4	66	297	660	1032	1102	973	737	410	154	22	5458
Royal Center	1918/19-1931/32	14	11	19	116	373	740	1101	1239	976	860	502	245	54	6239
Terre Haute	1912/13-1945/46	34	0	3	62	270	627	993	1072	897	687	358	133	15	5117
IOWA															
Charles City	1904/05-1945/46	42	8	24	164	480	906	1362	1535	1281	995	552	255	62	7624
Davenport	1898/99-1945/46	48	2	6	91	344	748	1176	1291	1111	835	448	171	29	6252
Des Moines	1898/99-1945/46	48	1	6	102	354	767	1204	1320	1132	843	446	171	29	6375
Dubuque	1898/99-1945/46	48	3	12	123	402	808	1249	1380	1190	915	493	204	41	6820
Keokuk	1898/99-1941/42	44	1	3	71	303	680	1077	1191	1025	761	397	136	18	5663
Sioux City	1898/99-1945/46	48	3	11	128	402	844	1273	1402	1206	909	485	202	40	6905
KANSAS															
Concordia	1898/99-1945/46	48	1	3	68	288	670	1060	1144	954	712	365	142	18	5425
Dodge City	1898/99-1945/46	48	1	3	59	275	641	998	1046	868	668	351	139	20	5069
Iola	1905/06-1940/41	36	0	1	40	236	579	930	1026	817	599	282	98	8	4616
Topeka	1898/99-1945/46	48	0	2	56	254	623	1013	1096	917	659	326	116	13	5075
Wichita	1898/99-1945/46	48	0	1	41	221	576	947	1016	836	604	290	103	9	4644
KENTUCKY															
Louisville	1898/99-1945/46	48	0	1	35	217	549	881	931	816	588	298	93	8	4417
Lexington	1898/99-1940/41	43	1	3	48	258	601	916	964	862	650	352	123	14	4792
LOUISIANA															
New Orleans	1898/99-1945/46	48	0	0	0	23	145	304	323	247	129	31	1	0	1203
Shreveport	1898/99-1945/46	48	0	0	4	71	275	536	531	415	241	79	10	0	2132
MAINE															
Eastport	1898/99-1945/46	48	158	146	271	528	827	1224	1364	1238	1089	778	530	301	8445
Greenville	1907/08-1940/41 & 1942/43-1945/46	38	69	113	315	643	1012	1464	1625	1443	1251	842	468	194	9439
Portland	1898/99-1945/46	48	28	48	182	466	794	1182	1309	1188	997	671	376	136	7377
MARYLAND															
Baltimore	1898/99-1945/46	48	0	1	33	227	526	855	921	837	637	343	95	12	4487
MASSACHUSETTS															
Boston	1898/99-1945/46	48	7	15	98	338	647	1008	1108	1025	841	538	245	66	5936
Fitchburg	1898/99-1940/41	43	12	29	144	432	774	1139	1240	1137	940	572	254	70	6743
Nantucket	1898/99-1945/46	48	15	15	87	315	590	904	1010	967	866	619	366	121	5875
MICHIGAN															
Alpena	1898/99-1945/46	48	53	79	235	548	874	1238	1388	1321	1162	764	448	168	8278
Detroit	1898/99-1945/46	48	7	15	111	388	749	1124	1230	1134	927	566	253	56	6560
Escanaba	1898/99-1945/46	48	54	84	256	572	927	1329	1499	1382	1219	808	477	170	8777
Grand Rapids	1903/04-1945/46	43	8	20	128	422	764	1136	1248	1143	944	569	263	57	6702
Houghton	1900/01-1940/41 & 1942/43-1945/46	45	70	94	268	582	965	1355	1535	1421	1251	820	471	195	9030
Lansing	1910/11-1945/46	36	18	36	167	467	818	1190	1306	1178	995	600	294	80	7149
Ludington	1912/13-1940/41	29	41	55	182	472	794	1135	1271	1183	1056	698	418	153	7458
Marquette	1898/99-1945/46	48	86	99	258	555	926	1306	1465	1349	1193	794	494	220	8745
Sault Ste. Marie	1898/99-1945/46	48	91	110	285	616	965	1379	1572	1470	1291	826	487	215	9307
MINNESOTA															
Duluth	1898/99-1945/46	48	80	97	292	631	1066	1539	1714	1497	1254	804	515	234	9723
Minneapolis	1898/99-1945/46	48	8	23	167	481	942	1415	1587	1372	1072	577	260	62	7966
Moorhead	1898/99-1940/41	43	20	47	240	607	1105	1609	1815	1555	1225	679	327	98	9327
St. Paul	1898/99-1932/33 & 1937/38-1940/41	39	11	24	169	488	942	1412	1589	1371	1078	573	258	60	7975
MISSISSIPPI															
Corinth	1909/10-1940/41	32	0	1	13	142	418	669	696	570	396	149	32	1	3087
Meridian	1900/01-1945/46	46	0	0	6	99	322	525	539	440	274	107	17	1	2330
Vicksburg	1898/99-1945/46	48	0	0	5	76	267	483	503	407	236	82	10	0	2069
MISSOURI															
Columbia	1898/99-1945/46	48	0	3	62	266	621	1000	1076	916	655	337	120	14	5070
Hannibal	1898/99-1940/41	43	1	3	66	288	652	1037	1139	980	710	374	128	15	5393
Kansas City	1898/99-1945/46	48	0	2	51	239	598	993	1077	909	651	322	108	12	4962
Saint Louis	1898/99-1945/46	48	0	1	38	215	558	925	998	855	607	300	91	8	4596
Springfield	1898/99-1945/46	48	1	2	48	232	561	908	971	827	596	302	109	12	4569
MONTANA															
Billings	1909/10-1945/46	37	14	31	223	530	889	1215	1310	1102	923	555	315	106	7213
Havre	1898/99-1945/46	48	27	54	275	592	1012	1376	1532	1358	1102	614	341	133	8416
Helena	1898/99-1945/46	48	43	66	291	596	944	1252	1347	1157	990	639	413	192	7930
Kalispell	1899/1900-1945/46	47	66	102	332	636	968	1235	1339	1135	956	630	413	220	8032
Miles City	1898/99-1945/46	48	7	20	188	510	918	1322	1461	1267	997	545	275	81	7591
Missoula	1892/93-1945/46	54	37	56	275	606	951	1235	1331	1072	903	590	369	179	7604
NEBRASKA															
Drexel	1915/16-1925/26	11	4	6	95	405	788	1271	1353	1096	843	493	219	38	6611
Lincoln	1898/99-1945/46	48	1	5	85	325	732	1144	1242	1056	792	407	166	25	5980
North Platte	1898/99-1945/46	48	4	9	131	410	799	1163	1227	1039	846	480	227	49	6384
Omaha	1898/99-1945/46	48	1	4	84	324	744	1169	1280	1088	810	410	157	24	6095
Valentine	1898/99-1945/46	48	8	19	167	479	877	1246	1349	1166	962	563	287	74	7197
NEVADA															
Reno	1905/06-1945/46	41	8	18	140	407	697	959	1007	791	702	498	301	93	5621
Tonopah	1914/1915-1940/41	27	5	7	105	388	713	1010	1075	870	749	522	286	82	5812
Winnemucca	1898/99-1945/46	48	10	23	188	494	801	1090	1128	884	768	536	321	114	6357
NEW HAMPSHIRE															
Concord	1903/04-1945/46	43	18	49	189	497	823	1228	1345	1213	993	637	308	100	7400

State and Station	Years	No. of Seasons	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Sea To
NEW JERSEY															
Atlantic City	1898/99-1945/46	48	1	2	39	247	546	867	946	887	750	485	208	37	5
Cape May	1898/99-1931/32	34	1	2	38	221	527	852	936	876	737	459	188	33	4
Newark	1898/99-1923/24 & 1935/36-1940/41	32	1	6	65	295	635	980	1083	1002	794	448	162	29	5
Sandy Hook	1915/16-1940/41	26	1	2	40	268	579	921	1016	973	833	499	206	31	5
Trenton	1914/15-1945/46	32	1	6	63	301	604	957	1033	923	748	441	154	25	5
NEW MEXICO															
Albuquerque	1919/20-1945/46	27	0	0	27	258	646	913	955	708	592	322	91	5	4
Roswell	1905/06-1945/46	41	0	0	26	191	512	781	773	585	459	199	50	2	3
Santa Fe	1898/99-1945/46	48	12	15	129	451	772	1071	1094	892	786	544	297	60	6
NEW YORK															
Albany	1898/99-1945/46	48	4	15	117	411	753	1143	1271	1169	948	551	220	46	6
Binghamton	1898/99-1945/46	48	15	37	148	448	767	1137	1236	1155	950	584	267	74	6
Buffalo	1898/99-1945/46	48	15	24	126	413	745	1110	1226	1165	995	668	348	90	6
Canton	1906/07-1945/46	40	27	61	219	550	898	1368	1516	1385	1139	695	340	107	8
Ithaca	1899/00-1942/43	44	17	40	156	451	770	1129	1236	1156	978	606	292	83	6
New York	1898/99-1945/46	48	1	4	50	272	594	940	1028	953	771	465	172	30	5
Oswego	1898/99-1945/46	48	20	33	147	440	762	1151	1275	1188	1015	665	366	124	7
Rochester	1898/99-1945/46	48	10	26	132	423	751	1123	1227	1155	967	605	282	71	6
Syracuse	1903/04-1945/46	43	13	32	146	437	760	1147	1255	1167	972	611	283	76	6
NORTH CAROLINA															
Asheville	1902/03-1945/46	44	2	3	49	279	565	800	817	719	558	315	114	15	4
Charlotte	1898/99-1945/46	48	0	1	17	148	420	684	700	600	413	198	39	4	3
Hatteras	1898/99-1945/46	48	0	0	1	61	273	500	570	530	391	193	34	1	2
Manteo	1904/05-1928/29	25	0	0	7	113	358	595	642	594	469	249	75	7	3
Raleigh	1898/99-1945/46	48	0	1	17	153	415	681	702	615	429	210	46	6	3
Wilmington	1898/99-1945/46	48	0	0	5	90	306	520	531	479	320	144	24	1	2
NORTH DAKOTA															
Bismarck	1898/99-1945/46	48	21	44	244	595	1057	1520	1704	1479	1181	643	340	109	8
Devils Lake	1904/05-1945/46	42	42	76	295	687	1186	1676	1906	1615	1313	752	411	145	10
Grand Forks	1912/13-1940/41 & 1942/43-1945/46	33	32	60	274	663	1160	1681	1895	1608	1298	718	359	123	9
Williston	1898/99-1945/46	48	28	61	285	637	1104	1545	1733	1513	1226	671	368	130	9
OHIO															
Cincinnati	1898/99-1945/46	48	1	3	53	273	611	960	1008	898	668	369	130	16	4
Cleveland	1898/99-1945/46	48	7	14	93	354	684	1045	1143	1067	876	553	252	56	6
Columbus	1898/99-1945/46	48	2	6	68	314	670	1019	1081	975	749	432	165	25	5
Dayton	1911/12-1942/43 & 1945/46	33	2	6	71	369	660	992	1079	939	752	416	163	23	5
Sandusky	1898/99-1945/46	48	3	8	82	347	695	1067	1155	1066	862	536	232	42	6
Toledo	1898/99-1945/46	48	5	13	100	370	718	1097	1189	1083	887	533	227	47	6
OKLAHOMA															
Broken Arrow	1918/19-1930/31	13	0	0	28	169	513	805	881	646	506	212	61	5	3
Oklahoma City	1898/99-1945/46	48	0	0	22	153	455	792	846	684	457	200	58	3	3
OREGON															
Baker	1898/99-1945/46	48	54	72	259	534	848	1161	1222	984	827	601	418	217	7
Medford	1911/12-1940/41 & 1945/46	31	7	10	99	345	632	837	844	636	556	387	223	74	4
Portland	1898/99-1945/46	48	27	28	106	292	538	725	775	616	533	368	237	108	4
Roseburg	1898/99-1945/46	48	23	26	116	316	541	714	730	582	530	386	257	111	4
PENNSYLVANIA															
Erie	1898/99-1945/46	48	8	17	101	367	692	1049	1159	1105	922	591	284	68	6
Harrisburg	1898/99-1945/46	48	1	6	67	314	637	990	1073	973	757	425	146	23	5
Philadelphia	1898/99-1945/46	48	0	2	36	235	544	884	962	881	685	378	115	17	4
Pittsburgh	1898/99-1945/46	48	3	7	69	322	651	982	1042	964	751	444	166	29	5
Reading	1912/13-1945/46	34	1	5	69	301	606	957	1038	929	736	423	144	23	5
Scranton	1900/01-1945/46	46	6	22	117	460	717	1074	1162	1071	862	523	213	51	6
RHODE ISLAND															
Block Island	1898/99-1945/46	48	10	11	79	313	596	919	1030	984	875	618	354	108	5
Narragansett Pier	1898/99-1917/18	20	1	26	121	366	691	1012	1113	1074	916	622	342	113	6
Providence	1904/05-1945/46	42	6	16	101	358	668	1020	1106	1027	847	538	237	60	5
SOUTH CAROLINA															
Charleston	1898/99-1945/46	48	0	0	1	47	225	428	452	384	239	83	7	0	1
Columbia	1898/99-1945/46	48	0	0	6	95	327	560	568	482	305	126	18	1	2
Due West	1921/22-1931/32	11	0	0	9	142	393	594	651	491	411	158	39	2	2
Greenville	1917/18-1945/46	29	0	1	13	127	410	650	684	551	403	179	40	1	3
SOUTH DAKOTA															
Huron	1898/99-1945/46	48	10	20	159	502	962	1409	1572	1353	1039	573	271	70	7
Pierre	1898/99-1940/41 & 1942/43-1945/46	47	4	11	136	438	887	1317	1460	1253	971	516	238	52	7
Rapid City	1898/99-1945/46	48	15	28	192	495	842	1178	1280	1140	981	598	339	109	7
TENNESSEE															
Chattanooga	1898/99-1945/46	48	0	0	13	150	432	691	711	604	412	185	39	1	3
Knoxville	1898/99-1945/46	48	0	0	20	189	498	756	774	666	470	226	56	3	3
Memphis	1898/99-1945/46	48	0	0	14	126	387	670	716	600	386	157	33	1	3
Nashville	1898/99-1945/46	48	0	0	20	170	469	748	788	675	467	218	55	3	3
TEXAS															
Abilene	1898/99-1945/46	48	0	0	10	96	332	603	619	483	296	110	23	1	2
Amarillo	1898/99-1945/46	48	1	2	42	221	548	854	861	719	546	284	107	11	4
Austin	1926/27-1945/46	20	0	0	2	31	227	410	458	315	185	46	5	0	1
Brownsville	1908/09-1945/46	38	0	0	0	8	65	176	191	111	65	11	1	0	
Corpus Christi	1898/99-1945/46	48	0	0	0	11	102	255	282	204	93	17	1	0	
Dallas	1913/14-1945/46	33	0	0	6	70	293	574	600	437	281	91	15	0	2
Del Rio	1905/06-1945/46	41	0	0	2	35	203	413	413	262	139	31	3	0	1
El Paso	1898/99-1945/46	48	0	0	6	88	366	615	615	432	291	104	14	1	2
Fort Worth	1898/99-1945/46	48	0	0	5	79	285	553	586	463	270	97	16	1	2
Galveston	1898/99-1945/46	48	0	0	0	14	123	290	334	255	130	27	1	0	1
Houston	1909/10-1945/46	37	0	0	1	27	160	331	361	247	150	36	2	0	1
Palestine	1898/99-1945/46	48	0	0	4	67	261	496	512	401	236	80	11	0	2
Port Arthur	1917/18-1945/46	29	0	0	1	27	177	328	375	254	151	37	2	0	1
San Antonio	1898/99-1945/46	48	0	0	1	31	171	366	390	287	148	37	4	0	1
Taylor	1901/02-1940/41	40	0	0	2	56	234	462	494	375	214	64	8	0	1
UTAH															
Modena	1900/01-1945/46	46	6	11	156	499	832	1142	1190	944	816	567	338	97	6
Salt Lake City	1898/99-1945/46	48	3	5	98	371	712	1033	1093	871	716	446	236	66	5

State and Station	Years	No. of Seasons	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Season Total
VERMONT															
Burlington	1906/07-1945/46	40	23	51	209	530	870	1313	1467	1338	1111	694	399	106	8111
Northfield	1898/99-1942/43	45	62	112	283	602	947	1389	1524	1384	1176	754	405	166	8804
VIRGINIA															
Cape Henry	1898/99-1945/46	48	0	0	7	125	398	676	731	682	526	301	86	6	3538
Lynchburg	1898/99-1945/46	48	1	2	37	230	521	799	829	732	537	287	81	12	4068
Norfolk	1898/99-1945/46	48	0	0	9	129	392	668	712	650	483	254	62	5	3364
Richmond	1898/99-1945/46	48	0	1	27	196	486	780	814	722	538	278	72	8	3922
Wytheville	1902/03-1940/41	39	7	13	82	352	662	916	945	836	677	410	168	35	5103
WASHINGTON															
North Head	1902/03-1945/46	44	251	229	255	350	491	642	697	597	610	505	428	312	5367
Seattle	1898/99-1945/46	48	67	69	170	365	554	704	759	637	595	436	299	160	4815
Spokane	1898/99-1945/46	48	20	37	184	480	817	1061	1139	931	756	490	285	118	6318
Tacoma	1898/99-1945/46	48	71	75	190	390	581	737	786	658	612	455	313	171	5039
Tatoosh Island	1898/99-1945/46	48	301	295	325	421	534	654	716	627	643	537	454	350	5857
Walla Walla	1898/99-1945/46	48	5	10	90	315	662	910	981	770	571	354	186	56	4910
Yakima	1909/10-1945/46	37	8	17	124	395	778	1050	1125	837	624	374	193	60	5585
WEST VIRGINIA															
Elkins	1898/99-1945/46	48	15	23	115	403	722	1003	1033	947	763	489	229	58	5800
Parkersburg	1898/99-1945/46	48	1	3	56	286	617	930	977	882	660	369	129	18	4928
WISCONSIN															
Green Bay	1898/99-1940/41	43	17	38	179	494	889	1329	1493	1329	1087	658	327	91	7931
La Crosse	1898/99-1945/46	48	7	22	157	454	864	1339	1492	1281	990	531	232	52	7421
Madison	1904/05-1945/46	42	8	20	145	452	857	1296	1451	1246	1002	588	274	66	7405
Milwaukee	1898/99-1945/46	48	13	17	124	411	786	1203	1329	1177	959	617	341	102	7079
Wausau	1915/16-1940/41	26	26	58	216	568	982	1427	1594	1381	1147	680	315	100	8494
WYOMING															
Cheyenne	1898/99-1945/46	48	40	46	251	587	876	1144	1187	1064	996	720	460	165	7536
Lander	1898/99-1945/46	48	27	43	265	623	1021	1400	1427	1197	1006	669	410	155	8243
Yellowstone Park	1904/05-1940/41	37	125	173	424	759	1079	1386	1464	1252	1165	841	603	334	9605

Air Sterilization and Human Health

By Burgess H. Jennings, Chairman
Department of Mechanical Engineering
Technological Institute, Northwestern University

AIR STERILIZATION—one of the newer fields of engineering and medicine—presents a real challenge to the combined efforts of the engineering and medical professions. Something must be done to reduce the toll of airborne disease which amounts to a loss of the working effort of more than 500,000 people per year.

Intestinal diseases, such as typhoid fever, dysentery, etc., have been practically eliminated through water and sewage control. Air control is now the pressing problem. The engineer's role in this problem is that of reducing the number of pathogenic organisms in a given space to such a small amount that the chance of cross infection becomes remote. This objective can be reached by:

1) Air dilution using excessive amounts of outside air.

2) By filtering and electrostatic precipitation of bacteria and dust from the air circulated in a space.

3) By use of ultraviolet lamps, where these can be employed without causing damage to the occupants of the space.

4) By use of chemical vapors in the air.

Items 1 and 2 have definite physical and economic limitations which cannot be exceeded.

Item 3: Ultraviolet lamps have been approved by the American Medical Association and, where the problem of human exposure can be controlled, are quite effective. The most effective bactericidal range is the wave length of 2537 Angstroms and slightly above. Lamps which deteriorate in their wave length to less than 2200 Angstroms produce ozone and may be harmful. One hundred microwatts per square centimeter has been adopted as the unit of germicidal intensity. However, people under continuous exposure cannot stand more than 0.1 microwatts per square centimeter. The lamps must be so placed that the radiations are not delivered directly against the skin and eyes of the people in the space. Such lamps have been effective in reducing cross infections in hospital wards, barracks, schoolrooms, and have been employed for reducing molds in high humidity refrigerators.

Item 4: The effective use of chemical vapors for air sterilization goes back some seven years, when the high efficiency of certain of the glycols for killing bacteria in air was discovered. Triethylene glycol is the most effective one of this group. It is a high boiling temperature liquid (548 F) not readily volatile, but not much vapor is required in a treated space to kill bacteria. Under normal inside temperatures, a concentration of 0.004 milligram per liter of air is all that is required. At this concentration the material has no odor, is nontoxic, and cannot be observed by people in the treated space. Killing of bacteria under such conditions is almost instantaneous.

One of the big difficulties with using this chemical has been the problem of getting it into the air and controlling its concentration, as it is not possible to bring it up to its boiling temperature because it breaks down chemically. Thus, it is necessary to get the material into the air under partial pressures.

Based on a recent talk before the Chicago section of the American Society of Refrigerating Engineers.

SAM LEWIS' PAGE

Informal comment on heating, piping, and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, member HPAC's board of consulting and contributing editors

How to Purge Excess Oil From Big CO_2 Compressor

Readers of this "page" by Mr. Lewis often address questions to him about some of the many problems that arise in connection with the design, installation, or operation of heating and air conditioning systems. Such a question recently received asked about purging excess lubricating oil from carbon dioxide refrigerating machines

THERE ARE many carbon dioxide refrigerating plants remaining in service. While they are not generally as efficient, considering power output compared to work done, as are plants using some other refrigerants, they are successful in many specialized services.

Carbon dioxide is a relatively safe refrigerant. It is present in the air leaving our lungs and it is the factor that controls our rate of respiration. It does not become dangerous until the concentration becomes very high. CO_2 is employed for direct expansion in water-wetted air cooling systems, as for theaters. It is also used for very low temperature work. The expansion coils for air cooling systems generally are placed directly in the air stream and recirculated water is sprayed over the coils, both the coil surface and the water being arranged to absorb the excess heat from the air.

Carbon dioxide refrigeration was extensively used on shipboard, before the development of some of the newer refrigerants, for controlling the rate of ripening of bananas. These banana boats easily were adapted to serve for delivering meats and other food products during World War II and so, during the war, bananas were hard to get.

An inquiry has been made by a reader of this page concerning an approved method of purging excess lubricating oil from a large carbon dioxide compressor, and a pioneer manufacturer of this type of machinery has been kind enough to provide an answer. The cylinders of carbon dioxide compressors, operating at a condensing pressure of around 1000 psi, usually are machined out of solid steel billets, and the nature of the refrigerant requires that lubrication shall be provided where the piston reciprocates back and forth through the cylinder.

The oil recommended for a large CO_2 compressor has the following characteristics:

American Petroleum Institute gravity	22.8
Flash point	350 to 390 F
Fire point	420 F
Viscosity	250 Saybolt @ 100 F
Pour point	0 F
NPA color	10 or better
Carbon residue	0.008

A high quality oil, if properly filtered, can be reused several times since CO_2 and oil get along together without too much trouble.

A small amount of lubricating oil may be carried over with the liquefied refrigerant to the evaporator through the oil trap and following many hours of operation will require removal. Such removal may be accomplished by daily pumping down of the low side (with the liquid outlet valve at the receiver closed).

The compressor may be operated normally with the spray water pump running to insure that the low side coils are well wetted, and with the air delivery fan running. Thus, the expansion coils will become warm. Then the oil and scale

traps on the low side may be blown free of oil and debris before resuming the regular cooling routine. This operation should be repeated daily until the trap outlets show very little oil.

The spray water should be at a temperature of 50 F or warmer following the pumping down operation. This scheme is said to be acceptable and allowable, since the oil and carbon dioxide removed are not re-usable. There are modern swirl type oil and scale traps having relatively large reservoirs that encourage separation of the oil from the refrigerant.

It is stated that such oil as fails to be retained at the trap does no particular harm unless its quantity is excessive.

A suggestion is made that maximum coverage by the chilled water of the expansion coils is of great importance and that periodical inspection and meticulous correction of the water contact with the cold surfaces will insure maximum output from the compressor.

FIRE UNDERWRITERS APPROVE ALUMINUM DUCTS

The National Board of Fire Underwriters has approved aluminum for use in the installation of ducts for air conditioning, warm air heating, air cooling, and ventilating systems, the approval being granted on recommendation from the committee on air conditioning of the National Fire Prevention Association.

The 1948 edition of NBFU pamphlet No. 90 will contain the revision and will cover installation for residences as well as for industrial buildings. Copies of the standards may be obtained from National Board of Fire Underwriters, 85 John St., New York 7; 222 W. Adams St., Chicago 6; or Merchants Exchange Bldg., San Francisco 4. They may also be secured through local fire inspection bureaus which work closely with the NBFU.

The changes include a section which points out that aluminum, cadmium plated, or zinc coated hardware and fittings, such as nuts, bolts, clamps, sheet metal screws, and rivets should be used in the fabrication and erection of aluminum duct work.

Agree on Standards for Refrigerant Piping

New American Standard Available

Success of a long range program to reach agreement on standards for the pipe flanges and fittings used in refrigerating equipment has been announced by the American Standards Association, Inc. Sponsored by the American Society of Mechanical Engineers, the Heating, Piping and Air Conditioning Contractors National Association, and the Manufacturers Standardization Society of the Valve and Fittings Industry, a committee of national organizations, manufacturers, and users of pipe flanges and fittings worked through the procedure of the ASA to agree on standard dimensions, materials, and markings.

The new American Standard for Cast Iron Flanges and Flanged Fittings for Refrigerant Piping (Class 300), provides standard dimensions for flange facings, flange dimensions, drilling templates, center-to-face dimensions, minimum metal wall thicknesses, and marking. A minimum grade of material is also specified.

Through the use of this standard, designers and erectors of refrigeration plants will be assured that standard flanges and fittings for piping installations can be obtained easily through usual trade channels, says the ASA. Delays resulting from fittings of special dimensions will thus be eliminated. The refrigerant plant operator can reduce his store of repair parts to a minimum and still be assured that in the event of a shutdown for repairs, replacement fittings will be available from manufacturers or warehouses. This will prevent delays and protect perishable food stuffs and other valuable products held in refrigeration.

In the opinion of Lester W. Benoit, general secretary of the Manufacturers Standardization Society of the Valve and Fittings Industry and secretary of ASA sectional committee B16 on pipe flanges and fittings, this standard is "another example of the manner in which American industry is aware of its responsibility to its consumers and its constant effort to produce more and better goods for public consumption through standardization." In fact, Mr. Benoit explains, the producer interests will have to spend large sums for new equipment to meet the standard. For this reason, codification authorities and state legislatures are being asked not to make this standard mandatory until industry has had a reasonable time to change over its equipment. He explains that "sensible economy dictates that this should not be before the end of 1949."

H. N. Hermann, president of Harold N. Hermann and Associates, Inc., is chairman of a subgroup organized by sectional committee B16 which prepared the standard, and W. P. Kliment, Crane Co., is secretary of the subgroup. Chairman of the sectional committee in charge of the general program developing standards for all types of pipe flanges and fittings is Dr. Emmart LaCrosse, vice president and director of engineering of the Stone and Webster Engineering Corp., representing the American Society of Mechanical Engineers, with Mr. Benoit as secretary.

Copies of the American Standard on Cast Iron Flanges and Flanged Fittings for Refrigerant Piping (Class 300), B16.16-1948 may be obtained from the American Standards Association, Inc., 70 E. 45th St., New York 17, N. Y., for 45 cents.

"Open for Discussion"

DO YOU HAVE something to say about any of the articles published this month? An additional comment, or perhaps a question on some point? We follow here the custom of engineering society meetings in allowing a period for discussion following presentation of a paper. You are invited to contribute your views. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago

How to Analyze the Flexibility of Piping

Numerous articles on the various methods of analyzing the flexibility of piping systems have been published in HPAC during the past several months. This discussion on the September article supplements these other data

AFTER READING F. E. Wolosewick's article on methods of making piping flexibility analyses in the September HPAC, I wonder what his column analogy accomplishes. In general, the equations given and the opinions expressed seem in agreement with those of previous articles on this subject. The author has found it simpler to develop the equations from Castigliano's theorem of least work rather than from the general equations of flexure of columns.

It would seem that the actual solution of a problem by the proposed method involves the same steps as those advocated by Spielvogel, Wallstrom and Carlier in previous articles of this series; i.e., computing the center of gravity of the configuration and computing moments of inertia relative to the neutral axis. The equivalent column analogy structure shown in Fig. 2 of Mr. Wolosewick's article may, of course, contribute somewhat to an understanding of the relative resistance of the component parts. Then too, the discussion on the effect of the restraining moments at the anchor points also should assist in a better appreciation of the meaning of the "fixed end" assumption usually used in flexibility computations.

100 Percent Pre-Spring of Pipe Sanctioned

Mr. Wolosewick states that complete pre-strain of high temperature piping is desirable, although apparently not sanctioned by the code authorities. As a matter of fact, pre-springing a line 100 percent of the expected expansion would seem to be sanctioned by the Code for Pressure Piping. The only point is that the total amount of expansion must be provided for in such a calculation. The allowable stress in the case of power piping would be three-quarters of twice the 650 F stress value. For other piping systems it would be three-quarters of twice the room temperature stress value, but not to exceed 40 percent of the tensile strength.

Incidentally, the latest recommended English practice is reported to be pre-springing steam lines 100 percent. A survey of American practice, made in 1946, showed that two piping fabricators recommended cold springing 66-2/3 percent, while a third fabricator and two public utility companies recommended 50 percent. One of the major turbine manufacturers recommended between one-half and five-eighths of the expansion, while another advised use of one-half. It is believed a third major turbine manufacturer would have recommended 100 percent cold spring, since some of the large units made by this firm were installed with steam leads designed on that basis.

A comparison of the permissible cold stress and cold modulus of elasticity with the permissible hot stress and hot modulus for a temperature such as 900 F suggests that better utilization of chrome-moly piping systems (to care for thermal expansion) will result if the line is pre-sprung two-thirds of the computed expansion. Furthermore, a line supporting a reasonably high bending stress would seem to be less

susceptible to any disturbing force, and hence would require less sway bracing, vibration dampening, etc.

Pipe Pre-Spring Requires Care

The author's statements about permanence of pre-spring, if once established, are in line with the conclusions of others who have studied the problem. Obtaining cold spring, however, requires care in selecting closing joints so that only direct pulls or small moments are encountered. It is not always appreciated that slight inaccuracy in a pipe layout or fabricated element may easily eliminate the designed cold spring. For example, a deviation of only 1 deg from the designed position of a 20 ft run at right angles to a main run will offset over 4 in. of intended cold spring. Adequate supervision of closing joints, therefore, is necessary if dependence is to be placed on pre-springing a line.—ARTHUR MCCUTCHAN, senior research engineer, Tube Turns, Inc., Louisville.

IF A PROBLEM or two were solved by F. E. Wolosewick, the column analogy reasoning in his September article on piping flexibility would be easier to follow. It would be helpful to see the author's solutions to the two problems which have been solved by others in this series. From what appears in the article no apparent improvement over the elastic-center or the moment-area methods is found.

To be of general and practical interest, the author should explain more clearly his various steps of reasoning and should define more carefully the various factors which appear in equations. I believe that, even with considerable study, no one but the most expert could use the material contained to actually solve a problem.

In Fig. 1a, the physical significance of x_1 and y_1 is not clear and the text does not include sufficient descriptive elaboration. In Fig. 1c the outer limit of Δx is not indicated and also in Fig. 1 Δx and Δy signify expansion increments. In the physical structure sketch of Fig. 2 these terms denote finite distances; i.e., lengths of elements rather than increases or decreases in length. Moreover, in the equivalent column analogy structure of Fig. 2 these same terms are used to designate couples. The text material on page 80, following Equation 17, indicates that these terms represent expansions.—RENO C. KING, Ebasco Services, New York City.

REPLY BY THE AUTHOR TO ABOVE COMMENTS

AFTER READING Mr. McCutchan's interesting comments, I would like to explain certain ideas which I hope will clarify my article on piping flexibility.

I had a threefold purpose in presenting this article. The first purpose was to summarize briefly the entire field of piping analysis, to show that the various methods now in use originated from the basic theorem of work, and to explain briefly the technique involved in each method.

The second purpose was to introduce the modern concept of structural engineering, namely that of column analogy, and to show theoretically its application to the analysis of piping systems. Simultaneously, I incorporated the idea of moment distribution and indicated that both methods, when combined, offer possibilities for solving piping systems.

The third purpose of the article was to stress the importance of complete pre-strain of piping systems and to indicate the practical benefits which may be derived from such practice.

I have been using both methods in the analysis of piping systems for a considerable period of time and have found the column analogy concept so useful that I wished to call the existence of this tool to the attention of others.

Mr. King is somewhat correct in his criticism, that no one but the most expert could use the material contained to solve a problem. It was not my original intention to present, in this paper, a completely workable tool of analysis. My main purpose was to establish theoretically the analogy and to show the relationship between flexural stress in a beam and the direct forces in a piping system. I also stated, without offering proof, that the same ideas may be applied in the analysis of piping systems in space.

Strictly speaking, the only formal solution of the piping system is the algebraic one. This, of course, is out of reach of most engineering offices, since it requires the use of calculating machines and a definite tabular routine for setting up the necessary equations. In view of the reluctance expressed by many chief engineers and chief draftsmen to the use of calculating machines, one would hesitate to adopt an algebraic system.

Moment area and neutral point methods are, strictly speaking, analogies which are exceedingly useful in performing certain classes of mathematical computations. The introduction of the column analogy simply adds another analogy to the solution of piping systems. A full explanation of the application of this newer analogy to the solution of piping systems would require an additional article.

"OPEN FOR DISCUSSION"

Complete Pre-Strain Is Safest Procedure

I have been using complete pre-strain of piping systems over a number of years and am convinced that this is the only safe and correct procedure for the majority of piping layouts. To achieve that end, close shop and field supervision is essential. In important lines it is also advisable to provide closing pieces which should be fabricated in the field to match the balance of piping. Careful planning and insistence on design details being carried out will produce good installations.

In the various process industries, it is quite common to use a suction line equal to or even larger than the barrel of a centrifugal pump. As long as the line is not subject to heat, no problems will arise. As soon as such lines carry vapors and liquids at higher temperatures, expansion forces will be developed which, at times, will damage the pump. Inasmuch as the pump is operating at high velocities, any external force tending to distort it may induce dangerous vibrations. When such equipment is not functioning properly, the responsibility is generally placed on the supplier for not having designed a rigid piece of equipment. Actually the trouble is often due to the piping being too rigid. In instances such as this,

pre-springing the lines completely would eliminate stresses on the pump.

I agree with Mr. McCutchan's observations that the presence of bending moments in the pipe makes the line less subject to vibrations, and therefore more rigid. There are, however, several factors which should be analyzed first. Can the reactions be safely resisted by the equipment? What should be the stress in the pipe? Will the bolting at the flanges be overstressed, and will the control equipment in the line, if any, be dangerously strained? Or if there are any welding ells, will the stress on them be excessive?

If the piping in question were attached to pumps, turbines, and control equipment, I would, without any hesitation, completely eliminate bending moments from the piping system and would provide such vibration eliminators as are necessary. If the piping were attached to two vessels, I would induce only those moments within the system that would keep the stresses at least 30 percent under the elastic limit for the operating temperature, if such a limit exists. At elevated temperatures, say 900 to 1000 F, the value of the elastic limit is somewhat doubtful. In such instances, complete pre-strain would be far more desirable than utilization of fictitious stresses and letting the flow of metal at overstressed spots cause an equalization of stress.

Why Depend on Plastic Flow?

I am not very sympathetic toward the present tendencies of using creep values for flexural evaluation of piping systems. At our present state of knowledge, piping systems are analyzed as elastic, and to expect them to behave in a similar manner plastically is inconsistent with the original theses. Nor do I recommend the utilization of plastic flow to equalize stresses at dangerous points. It is comparatively simple to eliminate such stresses completely or to minimize them to the point where they will be of no consequence. It seems to me that complete pre-strain is more economical, produces better piping systems, and increases the useful life of the piping system.

With regard to Mr. King's comments, the values x_A and y_A are coordinates to any point on the bend, taken with respect to point *A*. This is clearly stated in Equation 3. Later on, the subscripts are dropped, as mentioned in the article.

Regarding the quantity Δx, as used in Fig. 1c, this quantity represents finite displacements in the *X* direction. If limitations were imposed on the expansion in the *X* direction, a line would be added showing the limit of movement.

Some doubt perhaps may exist in the minds of readers by the manner in which displacements were indicated in Fig. 2. The displacements Δx and Δy, as used in the figure, denote displacements between two fixed points. These increments do not indicate lengths of line, but only changes in lengths at any given temperature range.

The terms M_{xx} and M_{yy} are simply mathematical analogies in which the physical displacements are visualized mathematically as rotations on the elastic structure. This is one of the salient points of column analogy.—F. E. WOLOSEWICK, design engineer, Sargent & Lundy, engineers, Chicago.

SIZING PIPING FOR HOT WATER JOBS

IN REPLY to the comments of Lawrence J. Smith in the October HPAC on my article in the September issue, the simplified pipe sizing tables given in the article were based first of all on the premise that a designer is limited to the use of standardized pipe sizes, either steel or other, and also, on the smaller heating jobs, to about one-half dozen standard cataloged circulating pumps each direct connected to motors of fixed horsepower and speed characteristics.

The first step necessary in designing a forced circulation hot water heating system, after selecting the desired operating water temperature, is to determine the amount of radiation needed for the particular job. With this factor in hand, the designer must next calculate the gallons per minute to satisfy the load at this temperature. He must then compromise these requirements with commercial standardized pipe, circulators, and other accessories available to him on the market.

How well he does this compromising will measure the operating efficiency of the final installation. He may decide to change the operating water temperature and thus the required gpm and meet a smaller pipe size with an increased operating head; or he may step up to the next larger pipe size, which will mean a different gpm and operating temperature, and lower operating head in each case with a fixed standing radiation load.

With the use of the simplified sizing tables as given in my article, he is enabled to make these compromises at a glance after he has calculated his required radiation load. This seems to me a practical, a quicker, and just as accurate a method of sizing the component parts of a forced hot water heating job as any heretofore presented.—GEORGE D. BEALS, heating contractor, Providence.

SCALE FORMATION ON EVAPORATIVE CONDENSERS

THE "ARM CHAIR analysis" of the problem of scale formation on evaporative condenser coils by O. Germany, published on page 109 of the October HPAC, is particularly interesting because he has viewed the subject with an open mind. Generally speaking, his facts are correct; however, I would like to carry his deductions a little bit farther in the light of both theory and experience.

When we refer to the temperature of superheated gas entering an evaporative condenser, we must always distinguish between the temperature of the gas and the temperature of the tube wall, keeping in mind that it is the temperature of the tube which determines evaporation rate and probably scaling. It can be shown by well known theoretical calculations and by actual test results that, for the conditions existing in an evaporative condenser, the heat transfer rate from the dry gas to the tube is very much slower than from condensing vapor to the tube. The result is a very much larger temperature gradient in the superheated region between the gas and the tube wall so that the actual tube temperature in this region is only very slightly warmer than in the condensing region. It is important, therefore, to keep in mind that hot gas does not neces-

sarily mean a hot tube. The facts are, and they are well proven, that in the evaporative condenser, tube temperatures in the superheated region are very little hotter than in the rest of the coil.

Another fact that must be kept in mind is that the water which drips off the bottom of the coil is picked up from the drain pan by the pump and recirculated directly to the sprays located over the top of the coil. Thus, the temperature of the water sprayed over the top of the coil is the same as the water in the pan. There is a very small amount of cooling of the water from the time that it drips from the bottom of the coil until it reaches the pan. Thus, the water sprayed over the top of the coil is only slightly cooler than the water that leaves the bottom of the coil.

Why Scale Is Formed

As the spray water passes through the coil, it is subjected to heating from the temperature of the coil and to cooling by evaporation to the air which is being passed over the coil. The result is that the water first warms up because the air is fairly well saturated near the top of the coil. But as the water approaches the bottom of the coil it comes in contact with fairly dry air and its temperature is lowered. Thus, the water temperature enters and leaves the coil at substantially the same temperature but reaches a maximum temperature some place in the middle of the coil.

Each time water circulates over the coil, a small amount is evaporated with the result that there is a small but definite increase in mineral concentration. Now keep in mind that when scale is being deposited, a balanced condition exists. The balance exists between the ability of the water to hold the minerals in solution and the tendency for minerals to deposit on the warm tube surface. Thus, a slight increase in mineral concentration as the water passes from the top of the coil to the bottom of the coil can account for the more rapid deposit of scale on the bottom tubes. With continued operation, the concentration of minerals in the water will increase unless a portion of the water is drained off and replaced by fresh water.

There is ample evidence that incomplete wetting of tubes causes rapid deposit of scale. If a tube becomes alternately wetted and dried, each cycle leaves a permanent scale deposit. If insufficient water is sprayed over a coil, there is always the possibility of partially wetted areas existing on the tubes and this is especially true on the bottom tubes. It should also be noted that evaporation takes place much faster on the bottom tubes due to the fact that the air has not yet become saturated. With this faster evaporation rate, any failure at complete wetting of the tube will result in dry spots and resulting scale formation.

The Answer to the Problem

The answer to this problem is obvious and is borne out by much field experience. Use plenty of spray water so that the rate of concentration is kept to a minimum and the tube bundle is completely wetted from top to bottom. Two gpm of spray water per ton of capacity is the desirable minimum. Provide a positive bleed arrangement so that a definite amount of water is drained off in proportion to the amount that is evaporated. Small tubes or orifices tend to become clogged. Adjustable valves are useless because the man in the field generally shuts them off completely.

It is erroneous to consider that a desuperheating coil can reduce scaling either by reducing the gas temperature or by reducing the overall load on the condenser. The effect of superheat temperature on scale formation is discussed above. The use of a desuperheating coil does not reduce the load on the condenser because the rating of the condenser is invariably increased in proportion to the amount of heat removed in the desuperheating coil, thus leaving the loading on the tube bundle exactly the same whether the desuperheating coil is furnished or not. The way to reduce loading on the tube bundle is to provide ample tube surface and air quantity along with plenty of spray water.

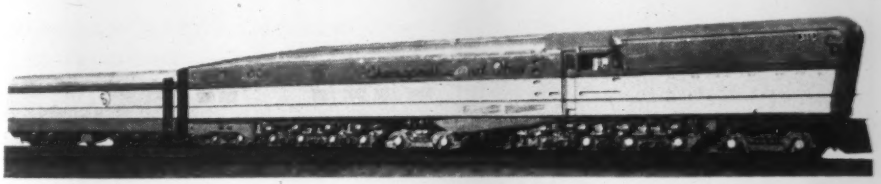
Let me repeat that extensive field experience and reliable data indicate conclusively that desuperheating coils will not reduce scale formation. Scale formation can be held to a minimum by using an ample quantity of spray water along with a positive water bleed arrangement and selecting a condenser with ample tube surface and air quantity to maintain reasonably low condensing temperatures. Under certain conditions, chemical treatment of the water may also be desirable.—D. D. WILE, chief engineer, Refrigeration Engineering, Inc., Los Angeles.

MAZE OF PIPING SERVES LOCOMOTIVE

Under its streamlined shell, America's first noncondensing steam turbine electric locomotive has a maze of piping for the many services needed to operate the giant passenger engine, including water, steam, steam condensate, air, sand, and others. Most of the pipe in the revolutionary locomotive is wrought iron. It is one of three built by the Baldwin Locomotive Works for high speed, deluxe passenger service on the Chesapeake and Ohio. Capable of speeds up to 100 mph, it is powered by a 6000 hp steam turbine connected to generators that produce electricity to drive the traction motors.

The coal hopper is housed in the nose in front of the operator's compartment and a mechanical stoker feeds the firebox. The boiler is in the center section and the turbine and generators are in the rear. The water-carrying tender blends with the streamlined passenger cars.

The noncondensing steam turbine electric locomotive is capable of a 100 mph speed



QUESTION OF THE MONTH

YOU ARE invited to submit a heating, piping, or air conditioning question for publication here. You are also invited to submit answers to previously-published questions from others. Those published are paid for at regular rates. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

Readers Present Ideas on Air Conditioning to Protect Records

Faced with the problem of air conditioning a few rooms containing valuable old records in order to prolong their life, "J.R.B." asked, in a question published in September, about the proper temperature and humidity, introduction of outside air, and how to make the air slightly alkaline. He said an air washer would probably be used for close humidity control. Several readers have submitted answers to or comments on this interesting question

I READ with interest the question of the month submitted by "J.R.B." regarding the proper air conditioning to prolong the life of records, since I recently had the same problem.

Paper is affected by (1) the harmful substances left in the paper after manufacture, and (2) the conditions under which the paper is stored and how and where it is used. Needless to say, nothing can be done by "J.R.B." about the first, so we will concern ourselves with the second.

Paper is affected by light, temperature, humidity, dusts, and acid pollution which may be in air.

Daylight should be excluded from the record room either by elimination of windows or by the use of special glass. Illumination should be kept to a minimum and turned on only when required.

Air temperatures between 65 and 75 F have been found to be satisfactory for both the preservation of paper and the comfort of the people required to work with records.

Where relative humidity is below 30 percent, paper becomes brittle and if above 75 percent, the growth of mold is encouraged. Therefore, a relative humidity of between 40 and 50 percent is recommended.

Dust acts as an abrasive on the paper and bindings of records as well as forming nuclei for the condensation of acidic moisture. Therefore, as much dust as possible should be eliminated. Electrostatic filters would be ideal, since they remove more of the finer dust particles.

Sulphur dioxide in the air forms an acid and reacts with the paper and tends to burn it. It is believed that the use of a mildly alkaline solution in humidifying and air washing equipment will neutralize the effects of the sulphur dioxide.

It is most important that the temperature and humidity be maintained at a constant level at all times and the removal of the records from storage be kept at a minimum, since change in temperature and humidity causes an expansion and contraction of the paper which shortens the life of the records.

In summary, the ideal library should have no outside light source, with a minimum of artificial light.

The air circulated in the rooms should be controlled as to temperature and humidity and all possible dust should be removed. All possible care should be taken to eliminate acidic properties of the air.

For further reference, I suggest the U. S. Bureau of Standards miscellaneous publication No. 128, A Survey of Storage Conditions in Libraries Relative to the Preservation of Records, and the U. S. Bureau of Mines bulletin No. 273.—K.E.R.

HOW THE PROBLEM WAS MET AT LARGE UNIVERSITY

I HAVE the following suggestion in reply to the question of "J.R.B." in the September HPAC.

The Clements library at the University of Michigan contains only historic books and records, the larger share of which date back to the American revolution. I presume the problem of preservation there is much the same as the one confronting "J.R.B."

Satisfactory preservation has been obtained in this library by insuring that the relative humidity may never go below 45 percent. This condition is maintained with an air washer having one bank of sprays downstream. To insure that the building is under pressure, all the air to be humidified is drawn in from the outside. It is heated and filtered before passing through the sprays.

No attempt is made to reduce the humidity when it goes above 45 percent. The summer humidities do not stay high enough in this area to cause mildew, so the fans need only be run for ventilation in summer.

As this library is in a residential area, the air from the outside is clean and fresh, making any further treatment unnecessary. However, one method of treating air that contains smoke and obnoxious gas would be to pass it through an activated carbon filter. This would absorb all fumes and deliver the air in a neutral condition.

I hope these comments will be of help to "J.R.B." and possibly to other readers of HPAC.—A.B.E.

ANNOUNCE WELDING AWARD PROGRAM

The trustees of the James F. Lincoln Arc Welding Foundation have announced September 15, 1948, to April 1, 1949, as the period for submitting entries in its annual engineering undergraduate award and scholarship program. The current competition is the second in a 10 year series of programs which offer to engineering undergraduates (including agricultural engineers) the opportunity to compete in the preparation of papers on various phases of welding for monetary awards as well as scholastic and industry recognition.

Contractor Reader Wants Comment on Scheme of Ventilating Club Kitchen

You are invited to answer the following question from "W.O.," a heating and air conditioning contractor. Suitable comment on this matter will be published, and paid for at regular rates (with additional payment for sketches). Address The Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"The kitchen at a country club is 20 by 30 ft with a 10 ft ceiling. Its front wall is at an areaway below grade with a door and a large window. The left side wall has a large service entrance leading to a hallway which connects to the rest of the basement and has wide stairs leading to the dining room section; the major part of it is against earth with 2 ft above grade adjacent to a lawn, and with two small windows. The rear wall is closed, with toilets and storage rooms behind it. The right side wall adjoins the boiler room and is otherwise solid excepting a 4 by 8 ft door leading thereto which is always kept open because from the boiler room lead two doors to the outside and it is believed that the cool air entering through these into the kitchen 'has the advantage' over the heat from boiler room.

"Along this wall are installed four gas fired kitchen ranges. There is a hood over them which connects to a sheet metal duct that leads upward through the first and second story of the wooden frame construction above, comprising office, lobby, diningroom, and guestrooms. The hood was disconnected some years ago from the duct and the latter closed up as a fire hazard.

"There is not too much complaint from the kitchen help in general, but the chef who must work at the gas ranges is always at the 'boiling point.' Five different ways of ventilating the kitchen have been proposed so far, ranging from the obviously inadequate to the extravagant. All have to do with exhausting the air from the range hood and, to some degree from the kitchen which, at the present, sports a 12 in. and an 18 in. wall fan.

"I believe that I have added slightly to the general suffering in the kitchen by installing a new 10 hp hot water generating boiler in the boiler room—which makes wonderful hot water for the entire place, but does throw out some other heat. So I have been asked what I thought should be done and (whether to be different or not wanting to share the blame by agreeing with one of the five proposals, I know not) I have recommended that the following should be done:

"Reconstruct the exhaust duct of the stove hood in a fireproof manner to the satisfaction of the authorities as a gravity vent.

"Install a large blower for the kitchen, but not as an exhaust but blowing air from the outside into the kitchen, thereby forcing heated air and fumes out through the openings. This would, of course, make closing the service door to the stairway leading to the diningroom necessary. It has swing doors anyway.

"What I should like to know is, whether ventilating by forcing outside air into the kitchen (instead of just exhausting kitchen air) is perhaps a hare-brained idea, and if so why? It would seem to me that if air was brought into the kitchen, there would be much better uniform ventilating. Also, at the least, there would not be drawn any fumes from out under the stove hood. There would be no exhaust ducts collecting grease and the job would cost less."—W. O.

Madison Square Garden Gets New Piping

A NEW arena floor for Madison Square Garden, New York City—the third since 1925—was recently laid in a record time of four weeks, and involves some 13 miles of concealed piping for brine. Since the floor has to stand up under the rigors of circus animals and equipment, prize fights and conventions, as well as satisfy the demands of ice hockey and ice shows, the piping installation has to be able to take extraordinary weights and vibrations as well as temperatures varying from 10 to 70 F.

Some 3000 black malleable couplings $1\frac{1}{4}$ in. in size were employed to connect, by silver brazing, 20 and 40 ft lengths of $1\frac{1}{4}$ in. standard weight, galvanized wrought iron pipe.

The piping, designed to withstand hydrostatic tests of 2500 psi, was laid over the original base of the arena floor, which had been covered with two new layers of waterproofed tar paper and one of zinc sheeting before the piping was put down.

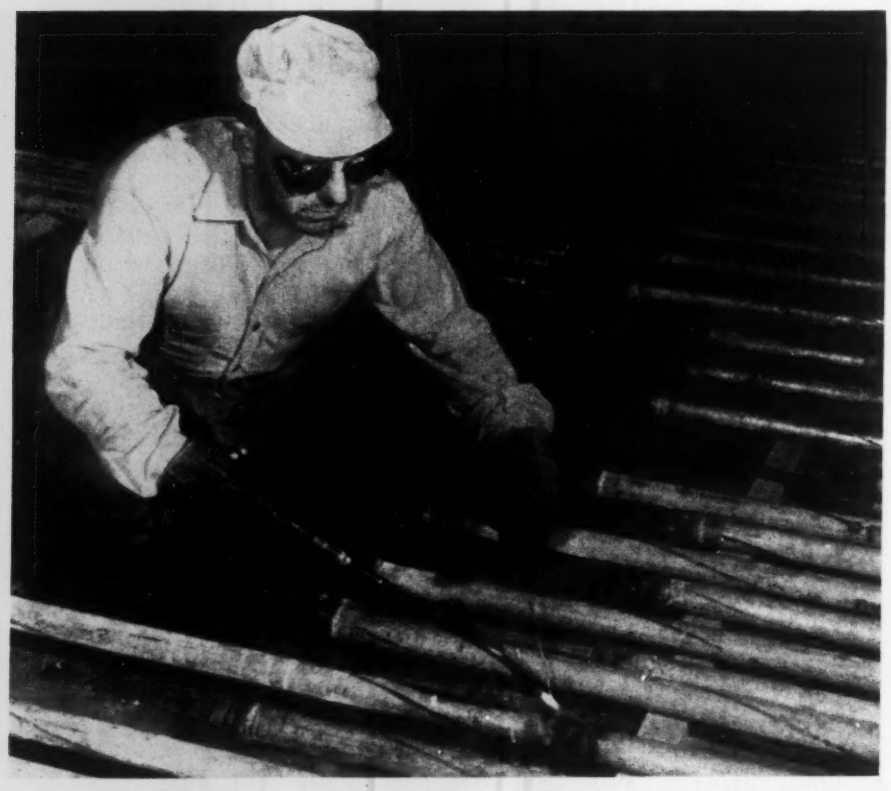
Tests, which were continuous throughout the project, began at the shop after the 20 and 40 ft lengths were joined by brazing. Here, the joints were covered with soapy water and 100 psi of air pressure forced through the pipe in a "suds" test, the appearance of air bubbles in the soap indicating any leaks.

Second test of the new couplings came as soon as the first headers of pipe were installed and eight 116 ft lengths put under hydrostatic pressure of 100 psi. These water tests were continuous throughout the job as header installations were completed, thus revealing weaknesses, if any, as the pipe lay exposed.

All told, out of about 6000 joints made with the fittings, only 181 leakers were found, and the majority of these were on the pipes prefabricated at the shop. According to the engineers, these were due chiefly to the eight different handlings these pipe lengths were subjected to. As these minor leaks showed up they were—with the exception of only a few joints repaired in short time on the site by the reapplication of heat to the pipe and fittings. These few joints were replaced with new joints.

With the pipe installed on its supports, the arena floor was then ready for the next step of pouring concrete. Some $3\frac{1}{2}$ in. of base concrete was poured in and around the pipe, with wire screen imbedded in this base to form a bond for the terrazzo bed, or scratch, coat, $\frac{3}{4}$ in. thick. The pouring of the entire floor was continuous, not exceeding a 4 hr period between the base concrete and the $\frac{3}{4}$ in. thick terrazzo. The pipe, then, rests $1\frac{1}{2}$ in. below the finished terrazzo floor. Before the job was considered complete, however, a sealing compound was applied over all the terrazzo.

The consulting engineer was Charles S. Leopold, Philadelphia; the architect was Lionel Levy, New York City; and the piping was installed by Almirall & Co., New York City.



Courtesy Stanley G. Flagg Co., Inc.

Operator applies silver alloy in completing one of the 6000 brazed joints in the 70,000 ft of galvanized wrought iron pipe for the Garden's new arena floor

ONE REASON STORES NEED AIR CONDITIONING

That hot weather adversely affects department store sales is well-known—as is the fact that air conditioning not only of stores but of practically all commercial establishments is a real business-getter and profit tool.

The point about hot weather is proved by such data as those in the weekly report of department and apparel store sales issued by the Federal Reserve Bank of New York. The comparisons between a week in August of this year with the same week last year for certain cities were indicated on this report as being "adversely affected because of unusually warm weather."

The remedy—air conditioning—should be quite obvious to store management.

Heating, Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

Heating A Basementless House With Radiant Baseboard

By R. H. Weigel* and W. S. Harris,** Urbana, Ill.

SUMMARY—Radiant baseboard radiation in a forced hot water heating system installed in a basementless house has been operated during the past heating season at the University of Illinois.

Satisfactory performance in regard to floor slab temperature, air temperature near floor and temperature differential between floor and 30-in. level are reported in this paper.

With thermostat located 30 in. above floor on inside wall of living room, the system responded quickly to changes in load, caused by rapid changes in outdoor temperature.

Comments are made upon observed indoor humidity, fuel consumption and cleanliness of the system.

DURING THE past year the University of Illinois, in cooperation with the *Institute of Boiler and Radiator Manufacturers,* investigated the performance of a radiant baseboard heating system in a basementless home. This supplements previous work done on radiant baseboard in the I=B=R Research Home.[1,2]

The object of the tests discussed in this paper was to determine the operating characteristics of a hot-water heating system using type RC, cast-iron, radiant baseboards in a basementless home. These characteristics included the temperature of the floor slab, the temperature gradients in the rooms, the operating temperatures in the hot-water system, fuel consumption, relative humidity, and cleanliness of operation.

Description of Equipment

House: The basementless home, shown in Fig. 1, was of prefabricated construction. The walls were composed of 3/8 in. fiber wall board on the room side, 2 in. by 3 in. wood framing members, and 3/8 in. plywood on the outside. One inch of cotton insulation, provided with a vapor barrier, was applied to the wall board between the framing members. The calculated coefficient of heat transmission, *U*, for this wall section was 0.16 Btu per (sq ft) (hr) (F deg) temperature difference. The ceiling was composed of 1/4 in. plywood, two inches of cotton insulation, and 2 in. by 4 in. joists. The *U* value was 0.13 Btu per (sq ft) (hr) (F deg) temperature difference. The house was erected on a 4-in. concrete floor and to minimize the heat losses at the edge of the slab, 1-in. waterproof board insulation was installed around the periphery and between the slab and foundation. A vapor barrier was placed between the slab and gravel fill to prevent vapor transmission. Calculated heat losses through the floor were based on a factor of 0.06 Btu per (sq ft) (hr) (F deg) and a temperature difference from room air to ground of 20 F deg.

All windows and doors were weatherstripped, and storm doors were used on both outside entrances. The total heat loss, based on —10 F outdoor temperature, and 70 F indoor temperature, was 42,750 Btu per hr. The total floor area of the heated space was 713 sq ft and the volume was 5702 cu ft. Table 1 gives a summary of the calculated heat loss, the volume, and the installed radiation in each room in the house. A floor plan of the house is shown in Fig. 2, and construction details of floor and walls are shown in Figs. 3 and 4.

Heating System: A gas conversion burner was used in conjunction with a wet-base type cast-iron boiler composed of two 6-in. sections and one 4-in. section, surrounded on top, sides and back with a 1-in.

* Special Research Assistant, University of Illinois.

** Special Research Associate Professor of Mechanical Engineering, University of Illinois. Member of ASHVE.

[1] A Study of Radiant Baseboard Heating in the I-B-R Research Home, by Alonzo P. Kratz and Warren S. Harris. (University of Illinois, *Engineering Experiment Station, Bulletin* 358.)

[2] Performance of Radiant Baseboard in Research Home, by A. P. Kratz and W. S. Harris. (*Heating, Piping & Air Conditioning*, Vol. 18, No. 1, Jan. 1946, p. 138.)

For presentation at the 55th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, Ill., January 1949.

thickness of air-cell insulation and completely enclosed in an enamelled sheet-metal jacket. All cracks between sections were sealed with asbestos cement. The net I=B=R rating was 55,000 Btu per hr.

A one-pipe, forced-circulation, hot-water system was used with type RC, cast-iron, radiant baseboards. These units, approximately 7 in. high, were located in the rooms as shown in Fig. 2. Paper-backed aluminum foil served as a dust seal to prevent the possibility of streaking the wall. The radiation in the living room and kitchen were connected in series and comprised one circuit, the two bedroom radiators were connected in series to form a second circuit, and the bath a third circuit. Furthermore, the piping was so arranged that the radiation in the bath could also be connected in series with the radiation in the two bedrooms and thus divide the system into only two circuits. The system was designed to operate with a mean water temperature of 215 F at 80 deg indoor-outdoor temperature difference, and a 20 deg drop through each circuit.

Three-quarter inch wrought-steel pipe was used almost entirely in the piping layout. In order that the system could be drained, the supply and return pipes in the concrete slab (see Fig. 2) were pitched downward to the sump in the utility room where drain valves were provided. Three-quarter inch air-cell insulation was placed around the pipe buried in the concrete. The insulation permitted sufficient movement of the pipe to provide for expansion in the system due to temperature changes and also it made it easier to connect the radiation to the supply and return piping at the time of installation. Each baseboard assembly was provided with an air vent to eliminate any air that might accumulate in the radiation or piping. The amount of radiation, together with the size and amount of pipe and fittings, are given in Table 2.

Table 1—Data on Basementless Home and Heating System

Room	Dimensions	Heated Space Cu Ft	Calculated Heat Loss Btu per Hr	Installed Radiation Low Height Type RC: Lineal Ft of Radiant Baseboard[a]	Installed Radiation Low Height Type RC: Radiation Installed Sq Ft[b]
Utility Room	8 ft-0 in. x 11 ft-10 in.	755	5928	—	
Kitchen	9 ft-3 in. x 11 ft-10 in.	784	6384	10	20
Living Room	11 ft-10 in. x 19 ft-10 in.	1869	13680	26	54
Front Bedroom	9 ft-11 in. x 11 ft-10 in.	935	7182	15	31
Rear Bedroom	8 ft-9 in. x 11 ft-10 in.	831	6612	14	29
Bath	5 ft-0 in. x 8 ft-1 in.	324	2394	5	10
Hall	7 ft-1 in. x 3 ft-7 in.	204	570	—	
	Total	5702	42750		145

Net I-B-R Boiler Rating = 55000 Btu per hour Gas Burning Rate = 100 cu ft per hour

[a] Based on a heat emission of 500 Btu per lineal ft at an average water temperature of 215 F.

[b] Based on a heat emission of 240 Btu per hour per sq ft at 215 F.

Control System: The control system, shown in Fig. 5, included a room thermostat, a high-limit control, a magnetic gas valve, a safety pilot, a transformer, and a relay. The room thermostat was of the heat-anticipating type, and in addition, contained provision for making three adjustments of the length of the burner and circulator operating cycle for a given outdoor temperature. The thermostat was located 30 in. above the floor on the east wall of the living room near the hall entrance, see Fig. 2. The high-limit control, which served to prevent overheating of the water in the boiler, was of the immersion type and was located in the back section of the boiler.

When heat was required, the gas burner and the circulator were started by the thermostat and both continued to operate until stopped by the room thermostat. If the period of operation was of sufficient duration to raise the temperature of the water in the boiler to 220 F, corresponding to the setting of the high-limit control, the latter would stop the burner. The circulator, however, would continue to operate. This system of control was used since domestic hot water was not being provided by the boiler.

Testing Apparatus: While the house was being erected, copper-constantan thermocouples were located in the living room and kitchen floor slabs, as shown in Figs. 3

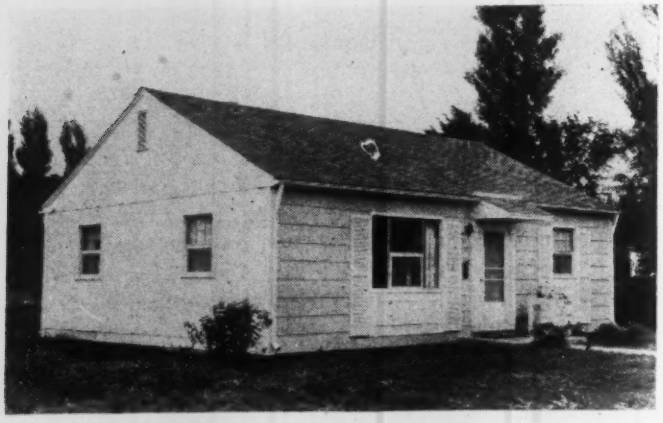


Fig. 1—Basementless home

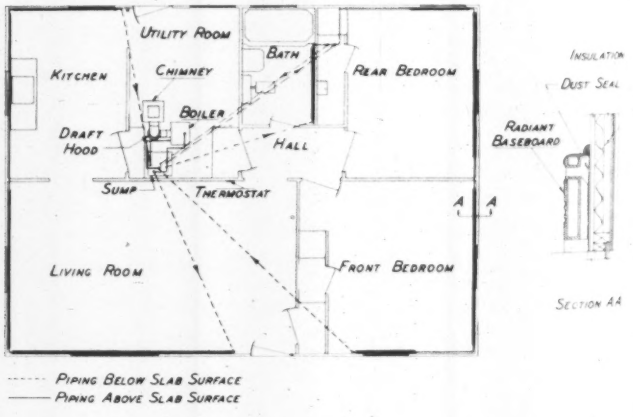


Fig. 2—Floor plan showing location of baseboard radiation

Table 2—Radiation, Pipe, and Fittings Used in Heating System with Radiation Connected in Two Circuits

Section	Installed Radiation	Pipe		Elbows		Tees		Unions		Specialties	
	Low Height Type RC Baseboard Radiation, Lineal ft	Size, in.	Length, ft	Size, in.	No.	Size, in.	No.	Size, in.	No.	Unit	No.
Bath-Bedroom Circuit	34	¾	54.0	¾	10	¾	1	¾	2	¾-in. valves	2
				¾-union	4						
Liv. Rm.-Kitchen Circuit	36	¾	36.2	¾	8	¾	2	¾	2	¾-in. valves	2
				¾-union	4						
Supply Trunk		½	2.9[a]	½	3	¾x½x¾	1	½	1	¾ relief	1
		¾	14.3[b]	¾	2	¾	1	¾	2	valve	
Return Trunk		1	0.5	1	1	¾x1x¾	1	1	2	1-in.	1
						1x1x½	1			circulator	

Pipe Totals		Elbow Totals		Tee Totals		Union Totals	
½ in.	2.9 ft	½ in.	3	¾ in.	4	½ in.	1
¾ in.	104.5 ft	¾ in.	20	¾x½x¾ in.	1	¾ in.	7
1 in.	0.5 ft	¾ in. (union)	8	¾x1x¾ in.	1	1 in.	2
		1 in.	1	1x1x½ in.	1		

[a] To expansion tank
[b] 6 ft drain from relief valve

and 4, respectively. It may be noted that slab temperatures in the living room were measured in a plane perpendicular to the west wall and that baseboard radiation extended not less than 7 ft-6 in. on either side of the plane in which the thermocouples were located. Therefore, the temperatures measured in this plane were fairly representative of slab temperatures that existed in any plane perpendicular to a wall at a point where baseboard radiation was located.

With one exception, the thermocouples in the kitchen floor slab were located in a plane perpendicular to the north wall and at a distance of 4 ft-10 in. from the baseboard radiation on the north wall of the living room and 4 ft-9 in. from the nearest radiation in the kitchen. Since the closest radiant baseboard was 4 ft-9 in. away from the plane of the thermocouple location, the temperatures measured by the thermocouples, shown in Fig. 4, were probably representative of slab temperatures that would have been obtained had no baseboard radiation been used.

A group of eight thermocouples was provided for the measurement of air temperatures at various levels in any room of the house. Four of these thermocouples were attached to a portable standard at levels of 3 in., 30 in., and 60 in. above the floor, and 3 in. below the ceiling. The other four thermocouples were similarly attached to a second standard. The lead wires to the thermocouples were of sufficient length to permit locating the standards in any room. The use of portable standards gave maximum flexibility in measuring air temperatures, and when not in use, they could easily be stored in the utility room. A third group of thermocouples was provided to study performance of the component parts of the heating system, including the temperature of the water entering and leaving each circuit, and the temperature of the water entering and leaving the boiler. A chromel-alumel thermocouple made of No. 22 B & S gage wire was located at the smoke outlet of the boiler.

A central switchboard was located in the utility room and all of the thermocouple leads were connected to jacks on this board. Each hot junction was provided with an individual cold junction which was maintained at 32 F by means of an ice bath. All cold junctions were insulated electrically by wrapping with thread and coating with ambroid. A portable precision potentiometer and a 10-point recording potentiometer provided means for either instantaneous readings of the emf of each thermocouple or continuous printed records of the emf given by any copper-constantan thermocouple. The range of the 10-point recording potentiometer, however, was from —1 mv to +5 mv which did not permit recording of the flue gas temperatures.

A recording hygrometer was used to make continuous records of the air temperature and relative humidity at the 30-in. level in the living room. This instrument was checked periodically with an aspiration type psychrometer. The CO_2 content of the flue gases was checked periodically with an Orsat apparatus. Self-starting electric clocks were connected in parallel with the gas valve and the circuit motor, and recorded the total time of the operation of each unit during the test period. A gas meter was used to measure the quantity of gas used.

Test Procedure

A gas burning rate of approximately 100 cfh was maintained

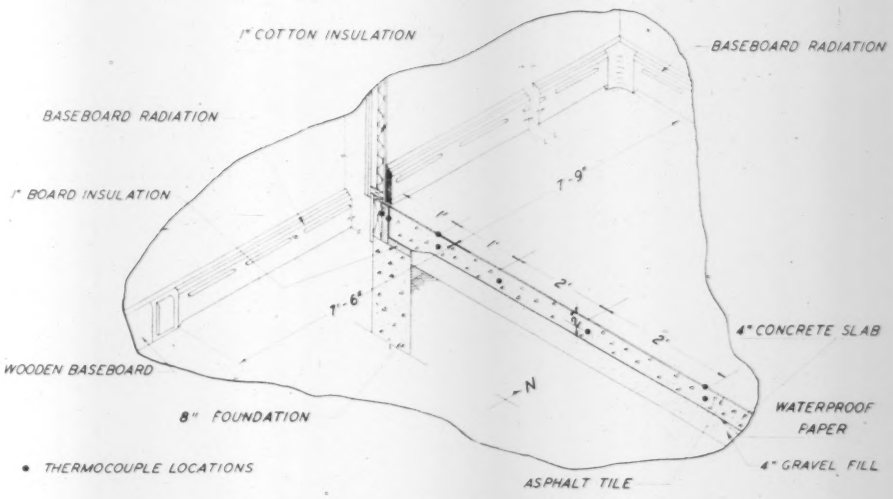


Fig. 3—Thermocouple locations in living room floor slab

during burner operating periods throughout the entire heating season. Burner adjustment was such that a CO_2 content of from 7 to 8.5 percent was obtained at the smoke outlet of the boiler. The natural gas used was supplied from the Texas-Oklahoma Pipe Line, and had a gross heating value of 1000 Btu per cu ft.

Since the house was occupied by a family consisting of a man, his wife, and one small child, cooking, washing and other domestic processes were carried on in a normal manner. Little attempt was made to control door positions between rooms. Although the occupants of the house generally kept the door between the kitchen and utility room closed, room air temperatures were not taken until the investigator assured himself that this door had been closed a minimum of 30 min prior to taking observations. Windows remained closed at all times. Observations of room air temperatures at 3 in., 30 in., and 60 in. above the floor, and 3 in. below the ceiling, were made at periodic intervals. Approximately every 48 hours, the operating time of the burner and the circulator, the cubic feet of gas consumed by the burner, and the floor slab temperatures were recorded. Periodic checks were made of flue gas temperature and CO_2. A continuous recording was made of the outdoor air temperature, the temperature of the water at the supply and return connections of the boiler and at the supply and return of each circuit. The relative humidity and air temperature at the 30-in. level in the living room were also recorded continuously.

During the main series of tests conducted during the 1947-48 heating season, the radiation in the bath was connected in series with the radiation in the two bedrooms to form one circuit of a one-pipe, forced-circulation hot-water system, while the radiation in the living room was connected in series with that in the kitchen to form a second circuit. A few tests were run, during which the radiation in the bath was connected to a separate circuit, thus permitting the turning off of radiation in the bedrooms at night. This series was abandoned, however, when tests in the I = B = R Research Home indicated that no fuel savings would result from this practice.

In all tests the thermostat was set to maintain an air temperature of 72 F at the 30-in. level in the living room both day and night.

Results

Slab Temperatures: Fig. 6 shows the variation in surface temperatures of the floor slab over a range of indoor-outdoor temperature differences. The upper curve shows that essentially no difference existed between the average surface temperatures at the approximate centers of the living room and kitchen. Further examination of this curve shows that average surface temperatures at the center of the kitchen and the living room remained practically constant at 70.5 F over the range of indoor-outdoor temperature differences from 0 to 40 deg. For indoor-outdoor differences greater than 40 deg, the average surface temperature decreased approximately 1.0 deg for each 10 deg increase in indoor-outdoor temperature difference. Thus, at the design condition of 80 deg indoor-outdoor temperature difference, the average surface temperature in the center of the room would be about 66.5 F.

The lower curves in Fig. 6 show that slab surface temperatures, one foot from the west wall in the living room and one foot from the north wall in the kitchen, were markedly different. As a result of higher water temperatures in the heating system in the colder weather, the floor surface temperature in the living room increased slightly as the indoor-outdoor temperature difference increased. The average surface temperatures in the living room were 70.5 F and 73.0 F for indoor-outdoor temperature differences of 10 deg and 70 deg, re-

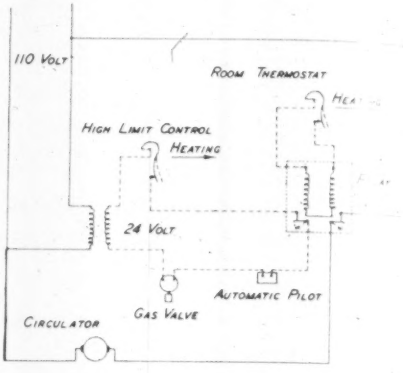


Fig. 5—Control system

Thermostat Calls for Heat: (1) Circulator and gas burner start; (2) Circulator runs until thermostat is satisfied; (3) Gas burner runs until thermostat is satisfied or until boiler water temperature reaches setting of high limit control.
Thermostat Satisfied: (1) Circulator and gas burner stop.

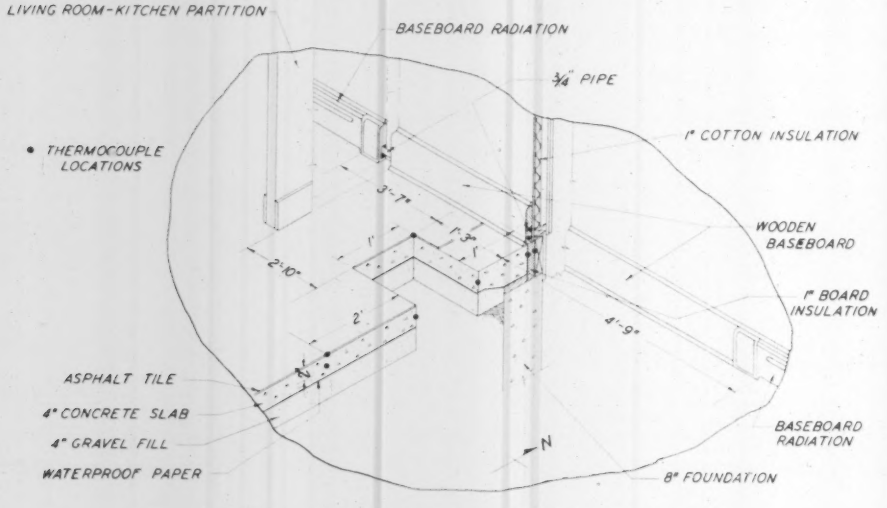


Fig. 4—Thermocouple locations in kitchen floor slab

spectively. In the kitchen, floor temperatures measured one foot from the north wall were influenced primarily by outdoor and indoor air temperatures. Hence, as the indoor-outdoor temperature differences increased, the surface temperature decreased. Average surface temperatures of 68.8 F and 61.0 F were obtained one foot from the wall in the kitchen at indoor-outdoor temperature differences of 10 deg and 70 deg, respectively.

An analysis of the data on the study of floor slab temperatures shows that the radiant baseboard is particularly adapted to maintaining comfortable floor temperatures in a basementless type of structure. Surface temperatures in the center of the room were always comfortable and wherever radiant baseboard was installed, temperatures near the edge of the slab were slightly higher than in the center of the room. However, where no radiant baseboard was installed, floor temperatures near outside walls were considerably lower; hence, the advantage of radiant baseboard lies in the large amount of outside wall exposure that a long, low unit of this type covers.

Room Air Temperature: In Fig. 7 the differences between the average temperatures of the air in the center of the living room, as measured at the 30-in. level, and at 3 in. above the floor, and 3 in. below the ceiling, are shown plotted against indoor-outdoor temperature differences. The scattered pattern of the points is attributed in part to the limitations in obtaining these temperatures with the house occupied. In order not to inconvenience the occupants, the portable standard was set up each time a set of temperature measurements was to be taken. The readings were generally recorded for a duration of 30 min and without regard to burner and circulator operation.

Fig. 7 shows that, in the basementless house, the temperature difference from floor to ceiling increased with indoor-outdoor temperature difference. At 69.5 indoor-outdoor temperature difference, the coldest weather at which these temperatures were measured, a difference of only 4.6 deg was observed between the average temperature of the air 3 in. above the floor and 3 in. below the ceiling. For all practical purposes this was about the same as that obtained with type RC radiant baseboard in the I B R Research Home[3]. The Research Home had a full basement.

Average air temperatures in the center of the living room of the basementless home, as measured 3 in. above the floor, were approximately 70 to 71 F for all indoor-outdoor temperature differences encountered. In the occupancy zone, 30-in. level to floor, temperature differences were only 1.0 to 2.0 deg. These results together with results previously obtained in the I=B=R Research Home[3] indicate that the radiant baseboard, if properly installed, will maintain excellent air temperatures in homes built with basements or in those built on concrete slabs in direct contact with the ground.

Fig. 8 is a reproduction of a seven-day recorder chart taken from an instrument located adjacent to the thermostat in the living room. During the course of the seven days that this chart was being made, three different settings of the thermostat differential were used. The chart illustrates clearly that the maximum and minimum air temperatures were affected by the length of the *on* and *off* periods of the burner and circulator. Long cycles of burner and circulator operation, obtained by setting the adjustable differential on the thermostat to position *C*, resulted in cyclic air temperature variations between *on* and *off* period of approximately 1.5 deg. Intermediate cycle length, obtained with the position of *B* setting, gave a variation of about 1 deg, and short cycles, obtained with the position of *A* setting, gave practically no variation in the living room air temperature at the 30-in. level. Air temperature variations near the ceiling were slightly greater than those just referred to. Furthermore, the temperature variations in the living room were more pronounced than in the other rooms. Without the aid of thermometers, the occupants of the house could

[3] A Study of Radiant Baseboard Heating in the I B R Research Home. (University of Illinois. *Engineering Experiment Station, Bulletin* 358, p. 22.)

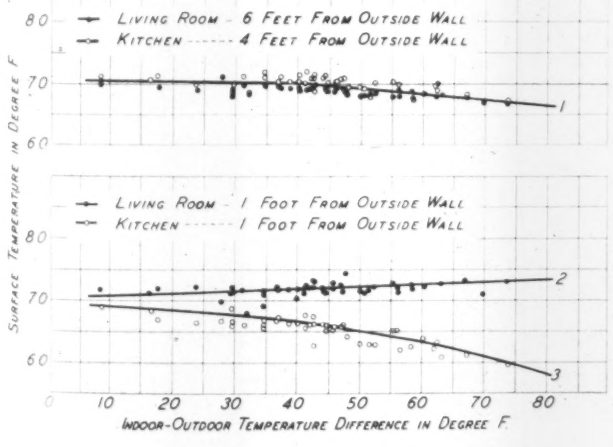

Living Room - 6 Feet From Outside Wall
Kitchen ------ 4 Feet From Outside Wall
Living Room - 1 Foot From Outside Wall
Kitchen ------ 1 Foot From Outside Wall
Surface Temperature in Degree F
Indoor-Outdoor Temperature Difference in Degree F

Fig. 6—Surface temperatures of floor slabs

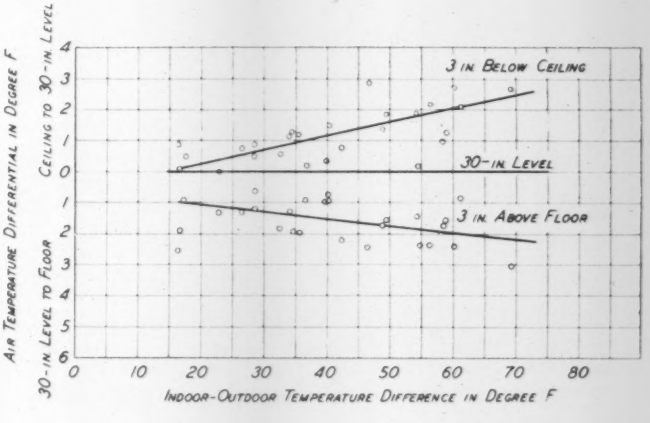

3 in. Below Ceiling
30-in. Level
3 in. Above Floor
Air Temperature Differential in Degree F
Ceiling to 30-in. Level
30-in. Level to Floor
Indoor-Outdoor Temperature Difference in Degree F

Fig. 7—Air temperature differentials in living room

not detect cyclic air temperature variations of 1.5 deg.

Fig. 8 also shows that, aside from the variations in air temperature discussed in the preceding paragraph, the outdoor temperature had no effect on the indoor air temperature at the thermostat level. The indoor air temperature remained constant even though there was a large and sometimes rapid change in the outdoor temperature. Thus, it is demonstrated that a hot-water system using radiant baseboard can take care of sudden changes in load with little difficulty.

The air temperatures at the 30-in. level in the living room were approximately 1.5 to 2.0 deg higher than those in all other rooms, except the bath. However, the radiation requirement for the bath room was based on an 85 deg indoor-outdoor temperature difference instead of the 80 deg temperature difference used for the other rooms. Air temperatures in the middle of any room, as measured at the 60-in. level, were approximately 0.5 deg higher than the temperatures measured at the 30-in. level.

Humidity: Humidity observations were made in the basementless home during the 1947-48 heating season even though no attempt was made to increase the indoor relative humidity by means of a humidifier. Curve *A* in Fig. 9 shows the relative humidity observed at the 30-in. level in the living room of the basementless home; curve *C*, the relative humidity which would have existed in the house if the absolute humidity indoors had been the same as that outdoors; and curve *B*, the relative humidity observed in the I-B-R Research Home[1] with no special means of providing humidification. Each test point represents the average relative humidity for a 48-hour period. The difference between curves *A* and *C* can be considered as representing the moisture added to the indoor air by cooking, by washing, by the occupants, by evaporation from building materials and house furnishings, and by evaporation from water normally used for general purposes in the house, minus that lost to the outside air.

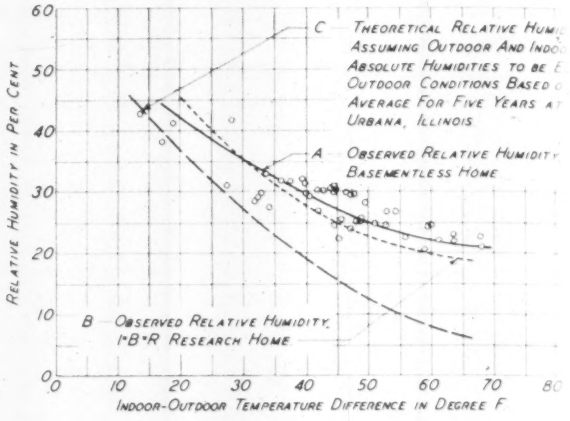

C Theoretical Relative Humidity Assuming Outdoor And Indoor Absolute Humidities to be Equal, Outdoor Conditions Based on Average For Five Years at Urbana, Illinois
A Observed Relative Humidity Basementless Home
B Observed Relative Humidity, I-B-R Research Home
Relative Humidity in Per Cent
Indoor-Outdoor Temperature Difference in Degree F
0
10
20
30
40
50
60
70
80

Fig. 9—Indoor relative humidity

It may be noted that the relative humidities observed in the basementless home and the I-B-R Research Home, as shown by curves *A* and *B*, are in fairly close agreement, yet no cooking or washing was done in the Research Home. Although both houses were insulated and provided with vapor barrier paper in the exposed walls and ceiling, and weatherstripping was applied to the doors and windows, the basementless home was not as tight in construction as the I-B-R Research Home. In the basementless home the outside doors and the butted joints of the prefabricated wall panels were not tight, and possibilities existed for considerable air leakage and vapor transmission. Thus, it is reasonable to assume that had the basementless home been of tighter construction, higher relative humidities would have been obtained. The problem of maintaining adequate indoor humidities for comfort in winter cannot be separated

[1] Performance of a Hot-Water Heating System in the I-B-R Research Home at the University of Illinois. (University of Illinois. *Engineering Experiment Station, Bulletin* 349. Fig. 27.)

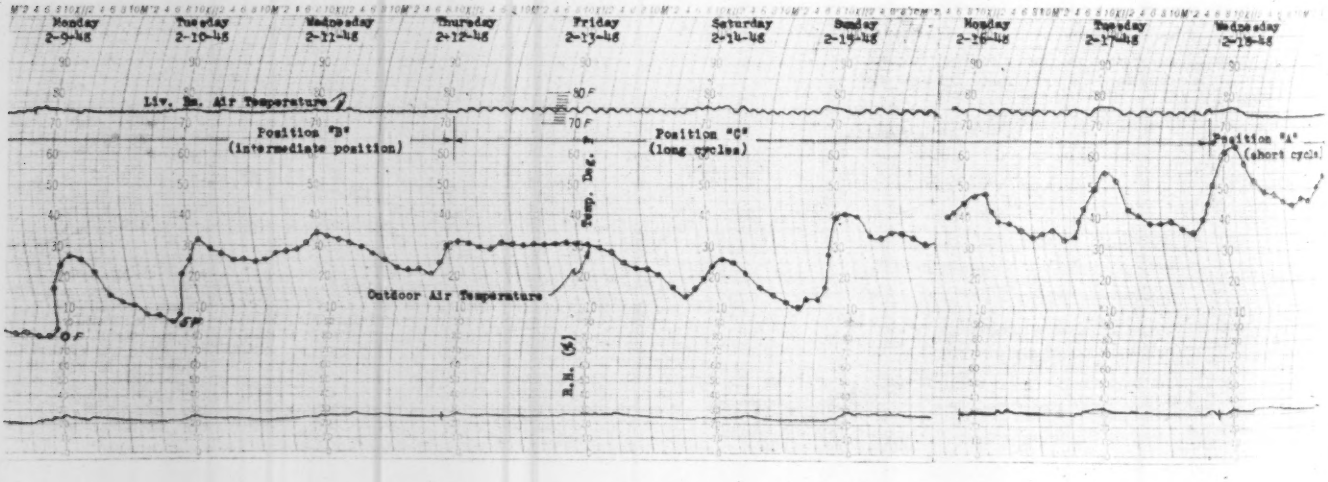


Fig. 8—Air temperature at the 30-in. level in the living room

from consideration of good building construction. If houses are tightly constructed little difficulty is experienced in maintaining an adequate indoor humidity in winter.

Water Temperatures in Boiler and Radiant Baseboard: As shown in Fig. 10, position *A* of the adjustable differential on the thermostat gave shorter *off* and *on* periods, and hence more cycles of burner and circulator operation, for a given indoor-outdoor temperature difference than did position *C*. It may also be noted that boiler inlet water temperatures for position *A*, at 36.5 F outdoor temperature, varied from 110 F to about 140 F, a range of 30 deg, while water temperatures for position *C* varied from 102 F to 191 F, or a range of 89 deg. These ranges of water temperatures at the boiler inlet are fairly indicative of changes in water temperatures in the baseboard radiation. Thus, with the shorter cycles of burner and circulator operation smaller fluctuations occurred in the water temperatures for the radiant baseboard and hence, smaller variations occurred in the indoor air temperatures.

In Fig. 11, curves *1* and *2* show the water temperatures obtained at the boiler outlet and return connections at the end of the circulator *on* period, whereas curves *3* and *4* show the water temperatures at the outlet and return connections at the beginning of the circulator *on* period. The arithmetical average of curves *1*, *2*, *3*, and *4* is represented by curve *5*. For all practical purposes curve *5* represents the average temperature of the water in the boiler for any given indoor-outdoor temperature difference. It is also representative of the average water temperature in the radiant baseboard.

The radiation installed in the basementless home was just sufficient to offset the calculated heat loss at an outdoor temperature of —10 F when the radiant baseboards were supplied with an average water temperature of 215 F. By extrapolation of the boiler water temperature curve *5* in Fig. 11 it will be found that at an indoor-outdoor temperature difference of 80 deg, the average boiler water temperature was 205.5 F, and the average water temperature in the radiant baseboards, which was essentially the same as the average boiler water

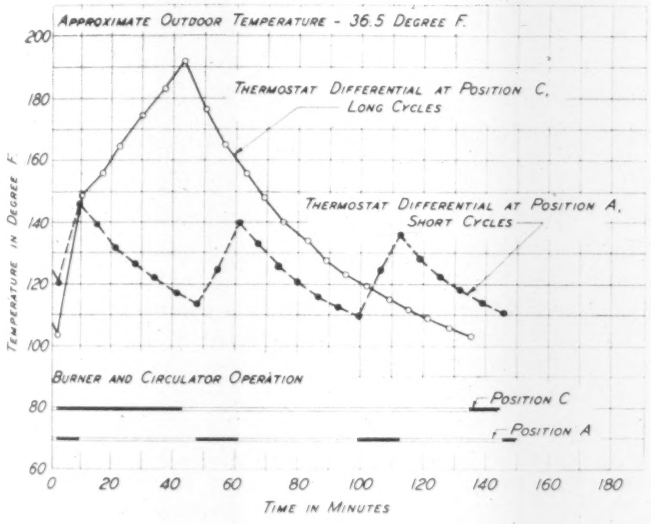
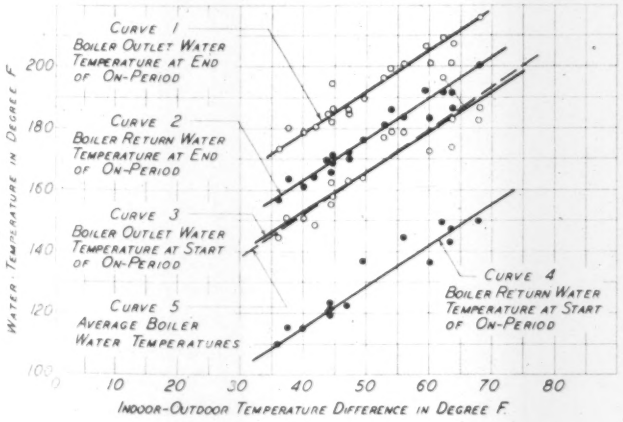

Approximate Outdoor Temperature - 36.5 Degree F.
Thermostat Differential at Position C, Long Cycles
Thermostat Differential at Position A, Short Cycles
Temperature in Degree F.
Burner and Circulator Operation
Position C
Position A
Time in Minutes

Fig. 10—Boiler inlet water temperatures, two positions of thermostat differential adjustment


Curve 1 Boiler Outlet Water Temperature at End of On-Period
Curve 2 Boiler Return Water Temperature at End of On-Period
Curve 3 Boiler Outlet Water Temperature at Start of On-Period
Curve 4 Boiler Return Water Temperature at Start of On-Period
Curve 5 Average Boiler Water Temperatures
Water Temperature in Degree F.
Indoor-Outdoor Temperature Difference in Degree F.

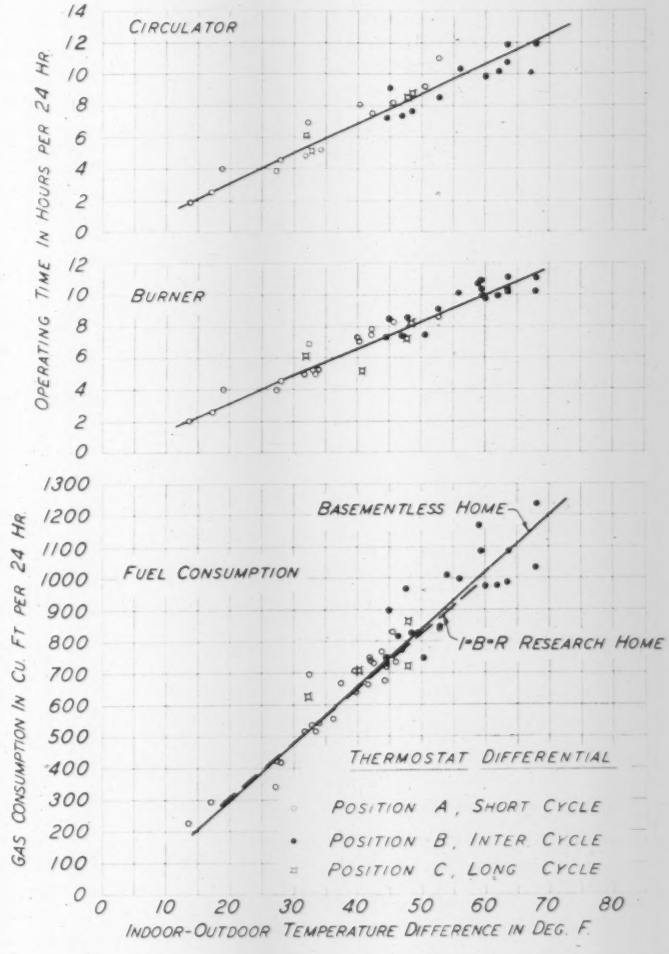


Fig. 12—Burner and circulator performance

Fig. 11 *(left)*—Boiler water temperatures

Table 3—Temperature Drop Through Boiler and Radiator Circuits with System Operating Near Design Water Temperature

Circuit	Avg. Inlet Temp F	Avg. Outlet Temp F	Temp Drop F Deg
TWO CIRCUITS			
Boiler	197.8	210.0	—12.2
Bath-Bedroom	209.5	197.7	+11.8
Liv. Rm.-Kitchen	209.3	199.5	+ 9.8
THREE CIRCUITS			
Boiler	196.5	206.5	—10.0
Bath	205.9	202.7	+ 3.2
Liv. Rm.-Kitchen	206.0	194.5	+11.5
Bedroom	206.0	192.5	+13.5

temperature, would have been about 9.5 deg lower than that selected for the design of the system. Thus, the amount of radiation installed was sufficient to carry the load at design conditions with only a small reserve capacity available.

Table 3 shows the temperature drop through the boiler and radiator circuits with both a two-circuit and a three-circuit flow. In the two-circuit system the bath was included in the bedroom circuit, and in the three-circuit system the bathroom radiation was in a circuit by itself. It may be noted that the maximum temperature drop that occurred in any circuit was 13.5 F Since the heating system was designed on a 20 deg temperature drop, it is evident that the flow of water in each circuit was more than ample to take care of the radiation connected to the circuit.

Fuel Consumption: Fig. 12 shows daily burner and circulator operating time and fuel consumption for operation at three settings of the thermostat differential. While changes in the thermostat differential had a marked effect on the length and number of operating cycles for any given indoor-outdoor temperature difference (Fig. 10), it may be observed in Fig. 12 that the setting of the thermostat differential adjustment had no appreciable effect on the total daily operating time of the burner or circulator or on the daily fuel consumption.

By extrapolation of the curve for burner operating time, shown in Fig. 12, a total operating time of only 13.5 hours per day would be obtained at an indoor-outdoor temperature difference of 80 deg, thus indicating that the burner and boiler had ample reserve capacity.

Since the calculated heat losses of the Research Home and the basementless house were in close agreement, the fuel consumption obtained in the Research Home, when using radiant baseboard, has been included in Fig. 12 and, as might be expected, the daily fuel consumption for the two houses was also in close agreement at all indoor-outdoor temperature differences.

Cleanliness of Operation: The basementless home was ready for occupancy in May 1947, and when heat was applied, all the walls were freshly painted and all the curtains and draperies were clean and new. After operating through a complete heating season of approximately nine months, faint dirt patterns were observed on some of the walls above the radiant baseboard. Curtains and draperies that hung over the radiant baseboard, however, were as clean as similar curtains and draperies under which no radiant baseboard was located.

Dirt patterns are the result of dust being carried close to the walls by convection currents and being deposited by thermal precipitation. Experience in the I=B=R Research Home and elsewhere, has indicated that dirt patterns may be eliminated by reducing the design water temperature in the radiant baseboard to 200 F or lower. This decreases the convection currents set up by the radiant baseboard and, hence, reduces the magnitude of the temperature gradient near the wall.

Summary and Conclusions

A summary of the test results of this investigation and the conclusions that may be drawn are as follows:

1. The radiant baseboard is particularly adapted to maintaining comfortable floor slab temperatures in a basementless structure, as long, low units of this type cover a large percentage of outside exposure.

2. Average air temperatures, as measured three inches above the floor, were approximately 70 to 71 F for all indoor-outdoor temperature differences encountered when the temperature at the 30-in. level was 72 F.

3. Temperature differences between the occupancy zone, as measured 3 in. and 30 in. above the floor, were only of the magnitude of a degree and a half to two degrees.

4. The hot-water heating system using radiant baseboard responded quickly to sudden changes in load, thus maintaining constant room air temperature even while the outdoor temperature was changing rapidly.

5. The problem of maintaining adequate indoor humidities for comfort in winter cannot be separated from consideration of good building construction. At 10 F outdoor temperature 22 percent relative humidity was obtained in the basementless home.

6. Fuel consumption was not affected by setting of the adjustable differential on the thermostat; however, water temperatures in the radiant baseboards, and consequent fluctuations in room air temperatures, were affected. The longer lengths of the *on* and *off* periods of the burner and circulator resulted in greater fluctuations of room air temperatures.

7. Faint dirt patterns were observed on some of the walls above the radiant baseboard after nine months of operation. Dirt patterns of this type can be eliminated by limiting the water temperature to a maximum of 200 F.

Acknowledgments

The results presented in this paper were obtained in connection with the investigation of steam and hot-water heating systems being made in the Department of Mechanical Engineering at the University of Illinois. The investigation is a cooperative project sponsored jointly by the Engineering Experiment Station of the University and the *Institute of Boiler and Radiator Manufacturers.*

This paper is largely an abstract of a thesis written by Mr. Weigel in partial fulfillment of the requirements for the Degree of Master of Science in Mechanical Engineering in the Graduate College of the University of Illinois. Also, these results will ultimately comprise part of a bulletin of the Engineering Experiment Station. Acknowledgment is hereby made to the various manufacturers who cooperated by furnishing materials and equipment.

Performance of Residential Chimneys†

By L. B. Schmitt* and R. B. Engdahl**,
Columbus, Ohio

SUMMARY—Four different types of residential chimneys were tested for performance under laboratory conditions. Some tests were run with simulated wind over the chimney top. Chimney performance varied only slightly with the differences in construction tested. Wind effects were large under some conditions, and were only partia ly counteracted by the chimney ventilator tested.

Recirculation of gases in the chimney and its effect on performance, are discussed. A method for calculation of available draft for a small residential chimney is given.

Fig. 1—Heater apparatus and flue pipe at Chimney No. 1 before insulation was applied to heater and pipe

CHIMNEY action is an important factor in the overall performance of residential heating equipment, whether the heater depends upon the chimney draft to supply the air for combustion, or only to move the products through the unit and then to exhaust them into the atmosphere. In the low-cost house particularly, because of the small size of the chimney, the chimney may be the deciding factor in the success or failure of the equipment which it serves. For this reason, it is important to establish reliable information on the performance of residential chimneys.

The information which is available in the literature includes a large number of opinions and calculations of theoretical chimney characteristics; experimental data on industrial chimneys; and also a recent extensive laboratory study of domestic chimneys made by Dill, Achenbach, and Duck[1]. However, these data are of limited value because of the large number of variables involved and because of the many questions regarding the operational characteristics of the residential chimney which still remain unanswered. The object of this paper is to seek an answer to some of these questions, inasmuch as they are of practical importance and they affect experimental techniques in chimney design.

Summary and Conclusions

The quickest and most reliable means for obtaining information on a chimney is through experimental measurement, inasmuch as the large number of variables affecting the operation of a chimney make precise chimney analysis not only extremely difficult but also limited in its application.

Tests were conducted on four different types of chimneys to obtain their operational characteristics. Two of the chimneys were common brick, one was constructed of lightweight materials, and one was an experimental double-walled chimney designed to overcome the effects of wind.

It was found that chimney efficiency varied only slightly with the various chimneys tested, and was not greatly affected by the materials or type of construction. The cross-sectional area did have some effect on the efficiency, but only insofar as it affected the friction and the recirculation losses.

Recirculation of the flue gases within the chimney and flue pipe was found to have considerable effect on the cooling and the friction losses. The effect of recirculation decreased as the rate of flow increased.

When the flow of gases was increased beyond approximately 200 lb per hr, to simulate chimney opera-

†This study of residential chimneys has been conducted at Battelle, for Bituminous Coal Research, Inc., the objective being to obtain information on small residential chimneys for hand-fired heating equipment.

*Research Engineer, Battelle Memorial Institute.

**Supervisor, Battelle Memorial Institute. Member of ASHVE.

[1]Exponent numerals refer to Bibliography.

For presentation at the 55th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, Ill., January 1949.

tion with stoker equipment, the draft and efficiency were found to decrease, the rate of decrease depending upon the inlet temperature. This effect was expected, since friction losses increase as the square of the rate of flow.

Tests were conducted under simulated wind conditions on the experimental double-walled chimney, and also on a commercial chimney top. Wind was found to have undesirable effects on both the double-walled chimney and the chimney ventilator. It is recognized that wind may have a deleterious effect on the operation of a short chimney because of the low available draft often provided by this type of chimney.

A method is described whereby the available chimney draft for the small residential chimney can easily be calculated within an accuracy of ± 10 percent.

Variables Affecting Chimney Performance

The large number of variables involved in the operational characteristics of a chimney makes an accurate, analytical approach to the problem of chimney design almost impossible. The most important variables are the chimney-flue inlet temperature, and the rate of gas flow. These factors include the effect of velocity on friction loss, and the effect on average chimney temperature. Other variables that must be considered, because at times they play an important part in chimney operation, are: height, elevation, cross-sectional area and shape, type of interior surface, conductivity of wall, leakage, outdoor temperature and humidity, specific heat and mass of chimney, tightness of house, wind velocity and direction, adjacent structures, and design of chimney top.

Two factors which do not affect performance but which must be carefully considered are cost and fireproofness.

The type of fuel burned in the appliance has not been mentioned as being an important variable because the amount of flue gas emitted per Btu liberated does not vary enough between various fuels to be of significance. Table 1 shows the net available heat, Btu per pound of flue gas emitted, for three common fuels.

Table 1—Net Available Heat for Various Fuels

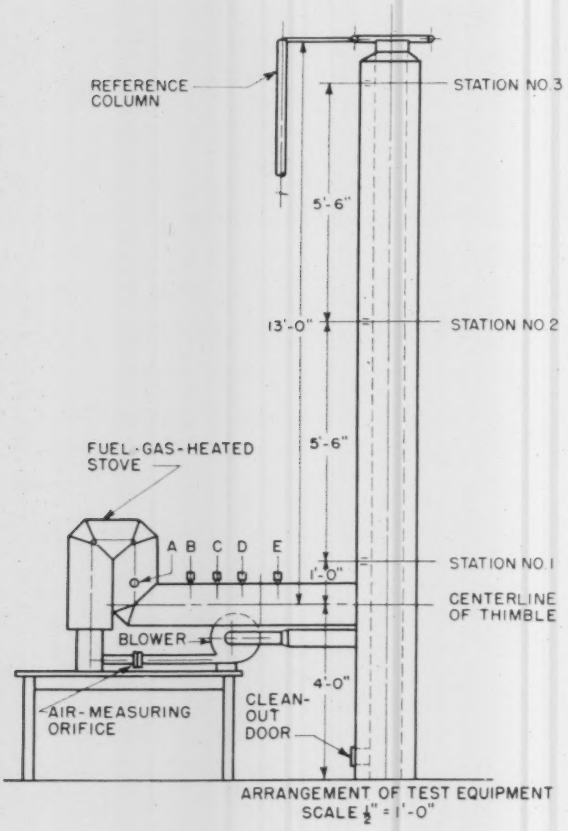
Fuel	Net available heat, Btu per lb of flue gas[a]
Pittsburgh bituminous	1170
Oil	1280
Natural gas	1300

[a]These figures are based on 0 percent excess air with all fuels[2].

In practice, however, the type of fuel is of consequence relative to soot formation, because soot deposits reduce the size of the flue area and consequently increase the friction of the flue.

Construction and Safety

Chimneys other than the conventional brick type include those made of lightweight, less expensive materials, such as asbestos cement, enamelled steel insulated with rock wool, enamelled tile, or other fireproof materials. The brick chimney has the advantage of being recommended, in the Building Code[3] of the *National Board of Fire Underwriters*, for oil, gas, or coal-fired



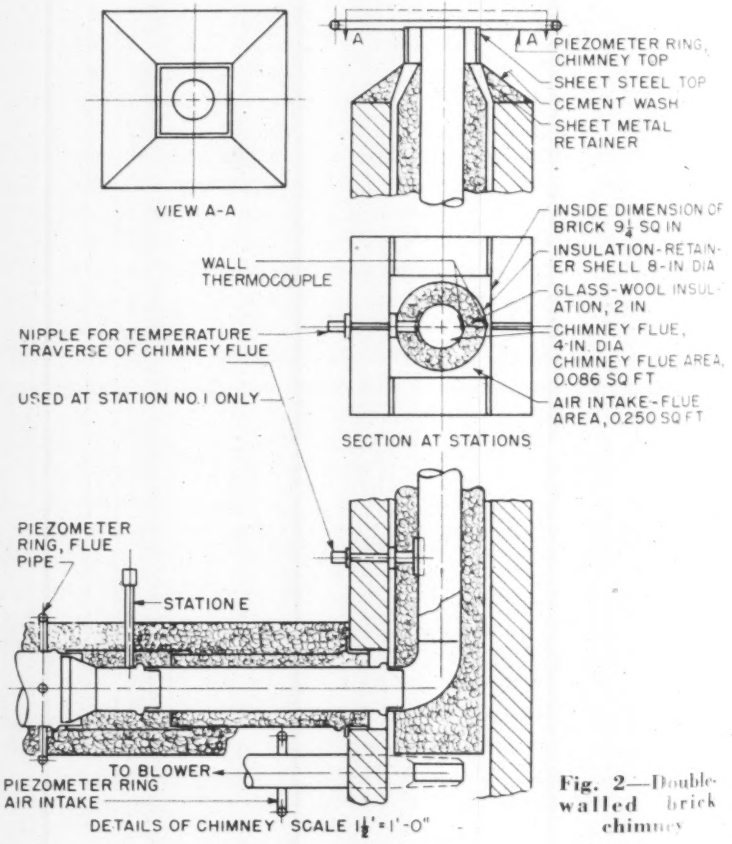


Fig. 2—Double-walled brick chimney

equipment, whereas few of the lightweight chimneys at the present time have been approved for all three types of fuel.

Definition of Draft

Draft is here defined as a *negative differential pressure;* thus, it is the absolute pressure at the thimble, less the absolute atmospheric pressure. The opposite of draft will be called *positive pressure* and will be defined as a positive *differential pressure.*

Test Equipment

Tests were conducted on four small residential chimneys each 13 ft high above the thimble and 17 ft above the floor, and constructed as follows:

Chimney No. 1 (see Fig. 1). 8 x 8 in. clay flue lining (6¾ x 6¾ in. inside) surrounded by 4 in. thickness of common brick laid in cement mortar. Space (approximately ½ in.) between lining and brick filled with cement mortar.

Chimney No. 2 (see Fig. 1). Same as No. 1, except that flue lining sections were not cemented together and the space between lining and brick was not filled.

Chimney No. 3 was of vitreous-enamelled flue pipe, 7 in. inside diameter or a cross-sectional area of 38.48 sq in., insulated with an expanded mineral material and enclosed in an outer steel casing 11 in. in diameter. This lightweight chimney was instrumented in much the same manner as Chimney No. 2, since only comparison tests were to be conducted.

Chimney No. 4. A 4 in. ID steel flue surrounded by 2 in. glass wool insulation enclosed in an 8 in. diameter retainer shell and enclosed in a 4-in.-thick brick chimney 9¼ x 9¼ in. (inside). The space between the retainer shell and the inside of the brick enclosure was used as an air supply duct through which air for combustion was drawn from the top of the chimney and delivered by the fan to the fuel-gas-heated stove (see Fig. 2).

The first chimney was a conventional brick type constructed according to recommendations of the Building Code[3]. A second chimney of identical size was built for comparative purposes, in order to check the differences of opinion among heating engineers regarding the desirability of air or mortar surrounding the liner. In this chimney the liner was dropped into place and the joints were left unsealed; this

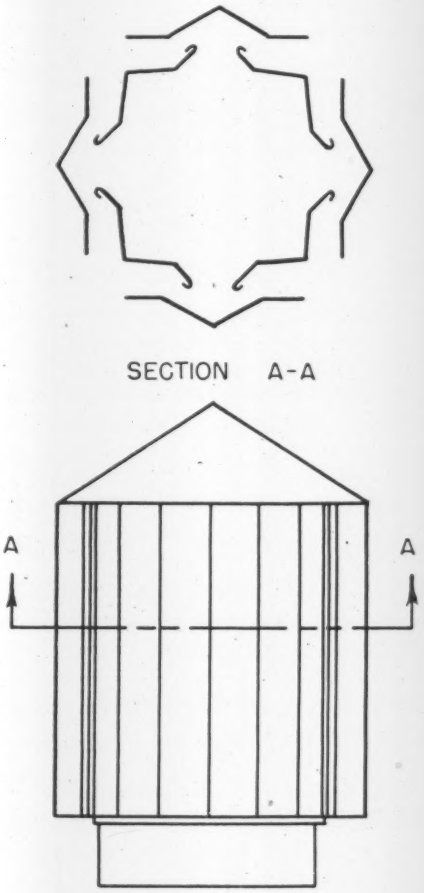


Fig. 3—Chimney ventilator

is common practice, though not in accord with the Underwriters' code.

Fig. 1 shows the two brick chimneys tested, also the combustion chamber (before insulation was applied) used to supply hot gas to the chimneys and the auxiliary equipment used in the tests. Both chimneys were constructed by a local bricklayer, who had considerable experience constructing residential chimneys. Chimney No. 1 was completely supplied with instruments to permit determination of flue-gas temperature at nine levels, surface temperatures inside and outside at these levels, and interior brick temperature at four points. The minimum of instrumentation was installed on Chimney No. 2, as it was to be used simply for comparison with the code chimney, to determine the effect of air space.

Wind Effect

Although no mention has yet been made of wind effect, it is a very important factor in the operation of a chimney. To combat this effect, P. C. Vyff, formerly associated with the project, proposed that the air for combustion be drawn from approximately the same point as that at which the flue gases were exhausted into the atmosphere. Theoretically, the wind should then have no effect on the chimney draft, because a gust of wind should pressurize equally both the combustion-air inlet and the flue-gas outlet; and then although the absolute pressures increased, the chimney draft should nevertheless remain the same. This principle was embodied in the double-walled Chimney No. 4 (see Fig. 2). The inside diameter of the center flue was 4 in., providing a cross-sectional area of 12.56 sq in.

Fig. 3 is a drawing of a chimney ventilator which was tested under a variety of wind conditions on the common-brick Chimney No. 2. The ventilator was a regular stock model of its type. Means for producing wind effect at the top of Chimney No. 4 are described in the following section.

Test Setup

A gas-fired heater was used to supply heated air and flue gases to all test chimneys. A small centrifugal blower delivered air through a measuring orifice to the base of the combustion chamber, in which were installed three gas burners. The top of this vertical, well-insulated chamber was connected to an inverted U-bend, made also of 7-in. pipe, insulated with 2 in. of rock wool and covered with a layer of aluminum foil. This inverted U-bend discharged downward into a vertical pipe, which had been incorporated to take advantage of the mixing of thermal currents inherent in this type of flow. From this vertical pipe, the flue gas was turned through a 90-deg elbow into the horizontal flue.

The temperature traverses were obtained with a high-velocity aspirating-type shielded chromel-alumel thermocouple (the accuracy of the temperature measurements was within ± 1 percent).

Because of the effects of adjacent equipment on the temperature of

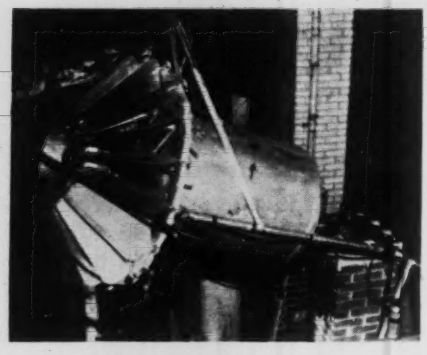


Fig. 4—Blower and double-walled chimney

the air surrounding the chimney, an insulated, water-cooled, copper-tube reference column was installed. This column, shown in Fig. 2, was employed to eliminate any effects on the manometer lines due to unequal ambient air temperatures surrounding the chimney, an effect which was found to influence the measured draft as much as 1½ percent. Detailed calculations converted the reference to a standard of 29.92 in. of mercury and 60 F.

A large blower was constructed to test double-walled Chimney No. 4, as well as the experimental chimney top under simulated-wind conditions. Fig. 4 shows this blower mounted at the top of the double-walled chimney. Through the use of a specially designed mount, the angle of attack and wind direction could be set at any desired position. Extensive tests were made with various cones mounted in front of the fan to make certain that the velocity profile was uniform across the blower over the entire operating range.

Test Procedure

The same test procedure was used for all chimneys tested. Tests were made at a number of nominal inlet temperatures and at various flows. Flue traverses were made at various points along the horizontal flue and vertical chimney to determine the temperature gradient. The efficiency of the chimney was computed from the test data thus obtained, as were also the heat loss and the friction loss. The chimney efficiency, in percent of theoretical available draft, was calculated as follows:

$$\text{Efficiency} = \frac{\text{available draft}}{\text{draft calculated from the inlet temperature}} 100$$

The percentage of theoretical draft lost, accountable to cooling in the chimney, was derived as follows:

$$\text{Cooling loss} = \frac{\text{theoretical draft} - \text{calculated draft based on average chimney temperature}}{\text{ideal draft}} 100$$

The percentage of theoretical draft lost because of apparent friction in the chimney was derived as follows:

$$\text{Apparent friction} = \frac{\text{calculated draft} - \text{available draft}}{\text{theoretical draft}} 100$$

Tests were made on the double-walled chimney and the chimney ventilator under a variety of wind conditions. With the temperature, flow, and direction held constant, the angle of attack was varied to see what effect wind at various vertical angles would have on the chimney draft. Tests were also conducted, in the same manner, to determine what effect wind direction had upon the chimney draft.

Chimney Characteristics

Recirculation and Temperature Gradient

Two reasons for two hitherto unexplained discrepancies that had appeared in data from previous chimney investigations[1] and which have also appeared in the authors' data, were disclosed from tests that were conducted on Chimney No. 1. The first discrepancy pertained to the temperature drop at the point where the flue pipe entered the chimney proper.

Fig. 5 shows the temperature gradient in a chimney tested by Dill[1]. The decided temperature drop at the thimble is shown clearly by this figure.

Figs. 6 and 7 show the temperature gradient and the vertical temperature profiles for several test conditions as found by a temperature survey made in the horizontal flue of Chimney No. 1. This was made to determine the type of flow occurring in the duct. From these figures can also be noted the sharp drop in temperature at the chimney inlet, and the variation in the temperature profile. Weske[4] has shown that for elbows of more than 30-deg angle of bend and of small radius ratio, separation does occur, frequently accompanied by a reversal of flow; whereas a region of eddying flow near the inside wall of the curved ducts is encountered in all cases. The chimney-temperature surveys and the work done by Weske would indicate that undoubtedly recirculation of the flue gases is taking place; hence the discrepancy in the flue-gas temperature at the thimble.

A sudden change in cross-sectional area may at times be of importance. An enlargement of the horizontal flue or vertical chimney flue may result in added reversal of flow (recirculation) because of the decrease in the velocity of the gases; while a decrease in cross-sectional area would cause an increase in the friction losses and possibly some recirculation before the restriction. This latter effect was noticed with the double-walled chimney where a decrease in cross-sectional area in the horizontal flue caused an uneven temperature gradient before the restriction, a condition which could only be attributed to internal turbulence.

Fig. 8 shows this uneven temperature gradient in the horizontal flue. It may be noted that the gases flow from the horizontal flue into Chimney No. 4 through a 90-deg elbow, while in Chimneys 1, 2, and 3, as in most chimneys, the horizontal flue is connected to the chimney by a tee. This latter arrangement in all probability would increase the recirculation losses.

Recirculation and Friction

The other important discrepancy was related to the effect of the friction loss, in the chimney, on chimney performance. It was found from previously published data on friction factors in roughened pipes[5] that the

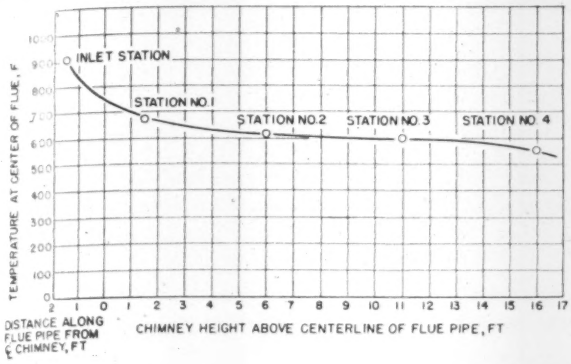


Fig. 5 *(Left)*—**Variation of average flue-gas temperature for a 17-ft chimney** *(data taken from Reference 1)*

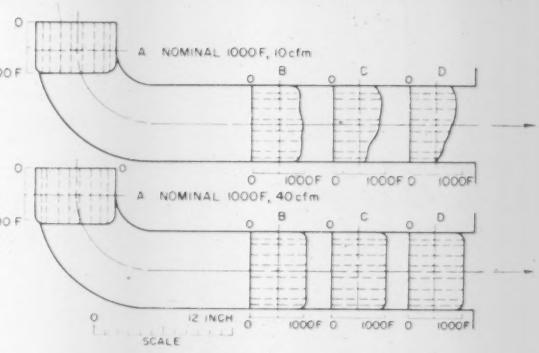


Fig. 7 *(Right)*—**Temperature profiles in insulated flue pipe showing effects of inlet temperature and flow rate on recirculation in chimney**

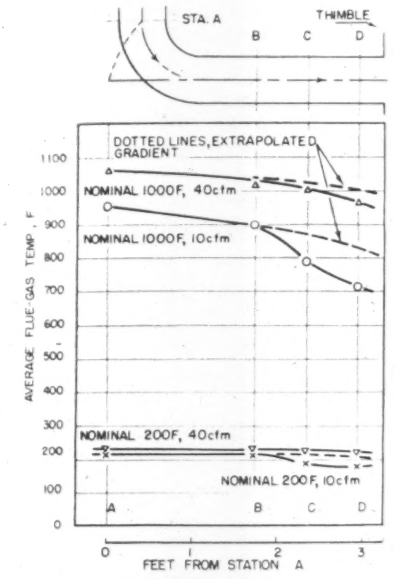


Fig. 6—Variation of average gas temperature along flue pipe

friction factor would, regardless of roughness, approach a maximum of 0.016, a value that is also recommended for chimneys in the HEATING, VENTILATING, AIR CONDITIONING GUIDE. But even with a friction factor of 0.016, the actual friction loss was much larger in the majority of tests than the calculated theoretical friction loss. When recirculation occurs, it affects the friction losses; therefore, it would appear that much of the apparent friction loss actually results from eddy and recirculation losses. The calculated friction is extremely small, and depends wholly upon the accuracy of the test data. It is believed that the test data, principally the temperature measurements, are not precise enough to warrant accurate calculations of the friction loss. An error of a few degrees in temperature measurement (and this error might again be blamed on recirculation) would have a considerable effect on the calculated friction loss.

Recirculation of the flue gases was found throughout the entire length of the chimney at low flows. This was verified by observing the flow of gases into the chimney top by the striation or shadowgraph method, in which it was noted that at extremely low rates of flow there were periodically small amounts of outside air which flowed into the chimney top, while the gases surrounding the chimney momentarily shifted to one side. However, as it was not observed at the higher flow rates, it is thought that in the practical range of flows this effect does not occur.

Correction for Recirculation

It has been pointed out that because of recirculation there is an appreciable drop in temperature where the flue gases enter the chimney; hence it can be seen that the chimney-inlet temperature obtained from a test survey and based on the extrapolated temperature gradient would not be a true indication of the chimney-inlet temperature. This chimney-inlet temperature would be some function of the recirculation, which is a factor that would be almost impossible to analyze.

For the first few tests, the theoretical temperature gradient of the horizontal flue was calculated from heat-transfer data. This new curve was extrapolated to the thimble of the chimney, and the resulting temperature was assumed to be the true chimney-inlet temperature. Fig. 6 shows this theoretical curve in dotted lines, but for the majority of tests the theoretical curve was used only as a guide, because a curve could easily be drawn that approached the theoretical with an error of only a few degrees.

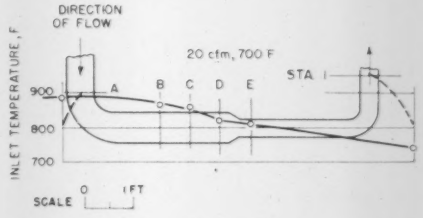


Fig. 8—Variation in horizontal flue temperature with reduction in cross-sectional area

Effects of Construction

The effects of the methods of construction on chimney efficiency were analyzed by comparing the results of the performance tests of Chimneys No. 1 and No. 2, and the comparison showed that the presence of an air space instead of mortar surrounding the liner in the brick chimney had no effect at all on the chimney operational characteristics. Moreover, there seems to be no appreciable insulating value in the air space. From a mechanical standpoint, therefore, the standard grouted-liner construction is preferable since it holds the liner in place when it becomes cracked.

Available Draft

Fig. 9 is a graphical presentation of the available chimney draft over a wide range of flows for a standard 13-ft brick chimney with an 8 x 8-in. (nominal-size) flue liner. Using performance values of the heating unit at full rating, it is possible to determine from this graph whether the chimney is adequate for the particular heating unit attached to it. By entering the chart at percentage CO_2, moving vertically to the curve representing pounds of flue gas per lb of fuel, then horizon-

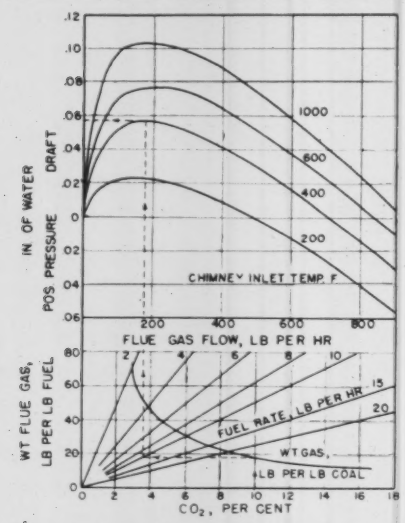


Fig. 9—Graphical evaluation of the available chimney draft from percentage CO_2, fuel rate, and chimney-inlet temperature ***(For Chimney No. 1, H.V. bituminous coal, 29.92 in. Hg, 60 F)***

tally to the fuel rate and vertically to the chimney inlet temperature, the available draft may easily be determined.

The use of this chart can best be explained by a numerical example: 10 percent CO_2, fuel rate 10 lb per hr, and a chimney inlet temperature of 400 F. These conditions, it can be seen, will give an available chimney draft of 0.057 in. water for a 13 ft chimney. The margin of capacity is obtained by comparing this value with the rated draft of the appliance.

With a chimney attached to natural-draft equipment, the draft obtained is an important factor in the correct operation of the heating equipment; but with a stoker which is under forced draft, draft is important only to prevent efflux of gas from the equipment.

It may be noted that for flow rates above approximately 200 lb per hr that the draft and the efficiency decrease. This effect is to be expected, as the friction loss in a duct increases as the square of the rate of flow.

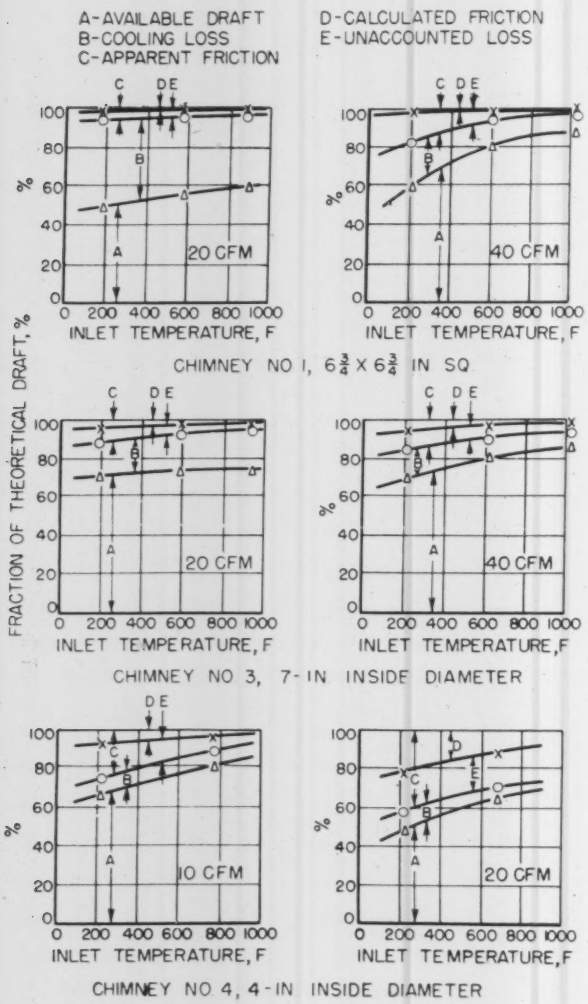


Fig. 10 ***(Left)*****—Draft balance plotted against temperature for three types of chimneys**

Fig. 11—Comparison of draft pick-up rates ***(Standard 13-ft brick chimney supplied with hot gas at 20 cfm at uniform rate, and the same chimney connected to a small coal-fired space heater)***

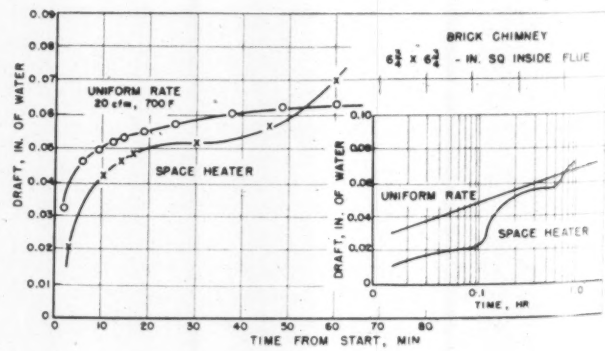
Efficiency

Fig. 10 shows the comparative efficiencies of Chimneys Nos. 1, 3, and 4: (A) is the fraction of the theoretical draft obtained as available draft, (B) is the fraction of the theoretical draft lost by cooling, (C) is the fraction of the theoretical draft lost because of apparent friction, and (D) is the fraction of the theoretical draft lost from calculated friction. The difference between the fraction of the theoretical draft lost because of apparent friction and the calculated friction is an unaccounted-for loss, (E). It can be seen that the average available draft lies between 70 and 80 percent of the theoretical draft for the average operating conditions, although Chimney No. 3, a lightweight insulated chimney, has a higher efficiency at low temperatures and flow rates than the standard brick chimney.

Pickup

With lightweight Chimney No. 3 there is a slightly faster rate of pickup than for a brick chimney, but the pickup rate of any standard chimney considered by itself is probably greater during the kindling period than is the combustion pickup of most coal-fired heating equipment. A possible exception to this rule would be with stokers, as these operate under forced draft and their pickup rate can be very high.

Fig. 11 is a comparison of two typical pickup curves, one for a brick chimney with the laboratory heater, and one for a small hand-fired space heater attached to the same chimney. It can be noted that the combustion pickup of the space heater and chimney is lower than the pickup when the chimney is



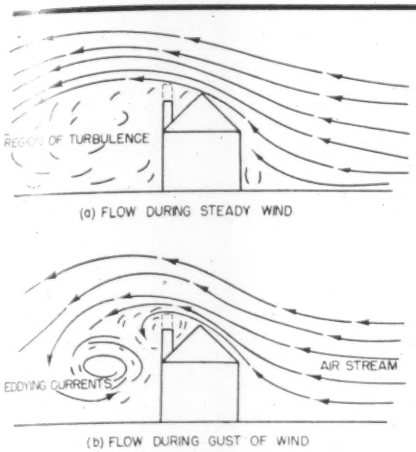


Fig. 12—Air flow over a building and chimney

supplied with hot gas from the start; hence the advantage of special pickup merits of insulated chimneys is small with natural-draft equipment.

Wind Effect on the Chimney Top

The varying effects of wind upon a chimney have always been a troublesome problem, inasmuch as air flowing around and over a building creates many eddies and vortices which may affect the chimney draft to a considerable extent. These effects may either be from ram pressure upon the chimney itself, or from the increase or decrease in pressure around the house because of the changing velocity of the air stream as it flows over the dwelling. Fig. 12, (*a*) and (*b*), shows the air flow over a small house and chimney for a gust of wind, and also for wind at a constant velocity[6]. To make the illustration clearer, the chimney height is shown below the ridge, and in dotted lines above the ridge of the house. It can be seen that it is important to build the chimney a few feet higher than the ridge to avoid the region of turbulence. It is frequently recommended that the chimney should be a foot or more higher than the ridge of the house, although exact dimensions cannot be given, because of the many varying physical conditions and the everchanging wind velocities. A chimney top only as high as or below the ridge may well be in the region of turbulence, and the result may be a marked decrease in draft.

A theoretical example of the increase in pressure at the chimney top due to change of velocity head to static pressure, *ram pressure*, at this point, was computed for an air-stream angle (angle of attack) of 30 deg above the horizontal plane of the chimney top, and a wind velocity of 40 mph. The increase in pressure under these conditions amounted to over 0.100 in. of water. For a small residential-type chimney this increase in pressure at the chimney top would probably be greater than the available draft, as an average draft of approximately 0.09 in. of water can be expected for a chimney only 15 ft in height. From this example it can be seen that for the smaller chimneys that are used for low-cost housing the ram effects of wind may become very serious.

The suction and pressure effects around the house which are due to the change in velocity of the air stream are almost impossible to evaluate with any degree of accuracy, but they too will have damaging effects on the performance of the chimney. It should be emphasized again that a chimney built above the ridge of the house will minimize these disturbances considerably.

Tests Under Simulated-Wind Conditions

The Double-Walled Chimney

The double-walled chimney, which was specifically designed to overcome wind effects, did not function as was hoped; wind had a marked effect upon the draft regardless of what measures were taken to counteract it. Compared to other chimneys previously examined, the efficiency of this chimney is favorable, which is probably due to the low heat loss. It appears that this type of chimney is no better than the conventional chimney in overcoming the effects of wind upon the draft, but it could be useful in homes where the tightness of the house would restrict the air for combustion, creating an adverse effect on the chimney draft. With this arrangement, the house could be perfectly tight without affecting the operation of the heating unit.

The Chimney Ventilator

Fig. 13 shows the results of the tests made on Chimney No. 2 under simulated-wind conditions both with and without the chimney ventilator shown in Fig. 3. The draft variation is plotted against the air-stream angle of attack for a wind velocity of 24 mph. It had been claimed that this chimney ventilator would increase the draft of the chimney; the claim was not substantiated by these tests, and above a velocity of 35 mph and an angle of attack of approximately 50 deg

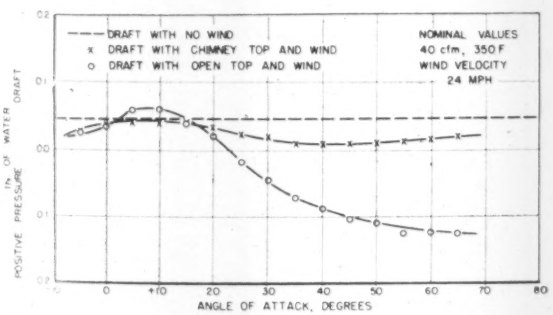

DRAFT WITH NO WIND
DRAFT WITH CHIMNEY TOP AND WIND
DRAFT WITH OPEN TOP AND WIND
NOMINAL VALUES
40 cfm, 350 F
WIND VELOCITY
24 MPH
POSITIVE PRESSURE, IN. OF WATER DRAFT
ANGLE OF ATTACK, DEGREES

Fig. 13 *(Above)*—Draft variation with change in angle of wind attack *(Under simulated-wind conditions with chimney top)*

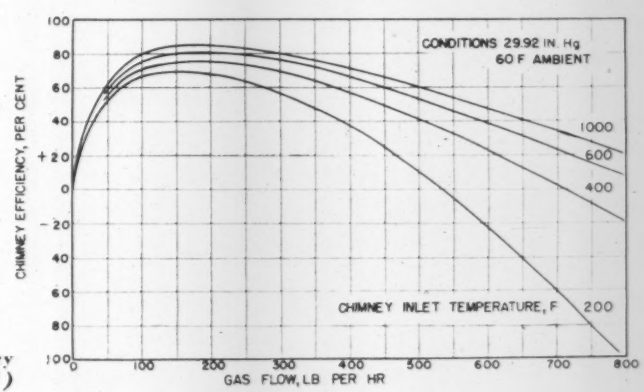


Fig. 14 *(Right)*—Curve of effect of flow on efficiency derived from temperature plots *(Chimney No. 1)*

from the horizontal instead of a draft, there was a positive pressure. (Not illustrated.)

A chimney ventilator, if properly installed and maintained, will in the majority of cases, counteract the wind to a considerable extent. There are cases, for example, a very tight house, where a chimney ventilator will not help; hence, it is not a *cure all* for all chimneys having poor draft, or those connected to equipment which may produce even a small amount of soot, the accumulation of which over a period of time might affect the operation of the ventilator by clogging the small passages.

Determination of Available Chimney Draft

One of the most important problems in the design and construction of residential chimneys involves the determination of the available draft for any small chimney. The available draft will be some function of the ideal draft, and the losses from conduction, friction, and recirculation. It can be seen that a rigidly complete solution for determining the available draft would be extremely unwieldy and subject to inaccuracies which would be due to the assumptions of various heat-transfer coefficients, friction factors, and other variables; hence, a reliable, approximate solution to this problem is desirable.

The available chimney draft may be written in the following manner,

$$D_a = \eta D_t \quad \ldots\ldots\ldots\ldots\ldots (1)$$

where

D_t = theoretical chimney draft, based on inlet temperature,

and

η = chimney efficiency.

It has been found from the test data obtained in this investigation that for a small residential chimney 10 to 25 ft in height, and with a cross-sectional area of 35 to 55 sq in., the chimney efficiency will vary only within ± 10 percent for chimneys at the same flow and temperature conditions regardless of friction and cooling losses; therefore, the product of the theoretical draft and the efficiency obtained from a previously tested chimney, at the desired flow and temperature conditions, will give an approximate solution for the unknown available draft. It may be expressed algebraically as:

$$D_a \cong \eta_c D_t \quad \ldots\ldots\ldots\ldots\ldots (2)$$

where

D_t = theoretical chimney draft, inches of water,

and

η_c = chimney efficiency taken from Fig. 14, at the desired conditions of temperature and flow.

Fig. 14 is a plot of chimney-efficiency test data obtained over a wide range of flows for common brick Chimney No. 1.

The theoretical chimney draft, in inches of water, may be computed from the following equation:

$$D_t = 0.2554\ BH \left[\frac{1}{T_o} - \frac{1}{T_c}\right] \ldots (3)$$

where

B = barometric pressure, inches of mercury;

H = chimney height, feet;

T_c = chimney inlet temperature, Fahrenheit absolute;

and

T_o = ambient air temperature, Fahrenheit absolute.

The slight change in efficiency due to the variation of the cooling and friction losses with changes in height, cross-sectional area, and materials, is disregarded in this method. This is done to simplify the procedure as much as possible, and to make a workable solution which can easily be used. It must be remembered, however, that it is only an approximate method for small residential chimneys with a height from 10 to 25 ft, and a cross-sectional area from 35 to 55 sq in.

An example of the use of this method may be had by comparing it with some actual test results. The following example is given: chimney height, 13 ft; inside diameter, 7 in. (area 38.5 sq in.); inlet temperature, 205 F; flow, 270 lb per hr, ambient air, 60 F, and barometric pressure, 29.92 in. Hg.

The theoretical draft as calculated from the draft equations:

$$D_t = 0.2554 \times 29.92 \times 13\left[\frac{1}{520} - \frac{1}{665}\right]$$

$$D_t = 0.0415 \text{ in. of water.}$$

From the curve in Fig. 14 the chimney efficiency may be found:

$$\eta_c = 0.60.$$

Substituting η_c and D_t in Equation 2 and calculating,

$$D_a = 0.60 \times 0.0415,$$

$$D_a = 0.0249 \text{ in. of water.}$$

The actual test results corrected to 29.92 in. Hg at 60 F gave,

D_a = 0.0239 in. of water,

Error = 4.2 percent.

The reliability of this method of determining chimney draft was further indicated when checking it with the results obtained from Dill's test data[1]. Calculations were made on a 22.3-ft chimney (inside dimensions 7.25 x 7.25 in.) correcting the available draft that he observed to 60 F. The available draft that Dill recorded compared within 6.9 percent of the draft that was calculated. This percent error is well within the allowed range.

If the percent CO_2 and fuel rate are the only known factors for the determination of the available draft for the unknown chimney, then the flue-gas flow may be determined from the lower plot of Fig. 9, and the problem worked as just described.

It should also be noted that at the higher flows which simulate operation with stoker equipment, the error due to friction losses will increase as the flow increases, but a reliable determination of the available draft may still be had at only a slight increase in error.

Acknowledgments

The contributions to this investigation of P. C. Vyff, F. B. Terrill, and W. T. Brown, are gratefully acknowledged.

Bibliography

1. Observed Performance of Some Experimental Chimneys, by R. S. Dill, P. R. Achenbach and J. T. Duck. (TRANSACTIONS, ASHVE, Vol. 48, 1942, P. 351.)

2. Steam Power Stations, by G. A. Gaffert. (McGraw-Hill Book Co., 1940. p. 169-171.)

3. The National Board of Fire Underwriters, Building Code, 1943, *Section* 1101, p. 186.

4. Experimental Investigation of Velocity Distributions Downstream of Single Duct Bends, by J. R. Weske. (NACA. Technical Note No. 1470.)

5. Strömungsgesetze in rauhen Rohren, by J. Nikuradse. (*V. D. I. Forschungsheft*, 1933, p. 361.)

6. A Study of Flow Phenomena in the Wake of Smokestacks, by R. H. Sherlock and B. A. Stalker, (Department of Engineering Research, University of Michigan, *Bulletin* 29, 1941.)

ASHVE RESEARCH PROGRAM

During the week of September 13, Cleveland was the focal point for a number of ASHVE Committee activities. The Committee on Research, two Technical Advisory Committees, and four other committees of the Society held meetings during the last three days of the week. Five of the seven meetings were held at the Research Laboratory.

COMMITTEE ON RESEARCH

The Committee on Research, under the chairmanship of L. N. Hunter, held a full-day meeting in the conference room at the Laboratory on Friday, September 17, with 12 members present. Several of the actions taken in this meeting should be of interest to the membership.

After an extended discussion of the many ramifications of the problem of odors in air conditioning, the Committee authorized the appointment of a Technical Advisory Committee on Odors. The scope of this committee will include studies on the formation, methods of measurements, and control of odors, and the physiological responses to them.

One of the problems continually before the Committee on Research is that of planning a research program that will be of maximum interest and value to Society members. It was decided to send a questionnaire asking each member to indicate the type of project he considers most important.

Industrial support of the Research Program during the past year has been most gratifying. It was reported that since November 1, 1947, industry has contributed or pledged over $70,000.

Meeting of Committee on Research, September 17, 1948

(L. to R.) **W. E. Zieber, T. H. Urdahl, M. K. Fahnestock, A. B. Algren, R. C. Cross, E. R. Queer, Miss I. M. Jahn, L. N. Hunter, C. M. Humphreys, L. G. Miller, R. D. Madison, W. O. Huebner, C. W. Johnson, John James**

Meeting of TAC on Industrial Ventilation, September 16, 1948

(L. to R.) H. E. Ziel, W. M. Wallace, II, W. B. Harris, M. G. Kershaw, C. W. Johnson, Miss I. M. Jahn, W. N. Witheridge, L. G. Miller, L. L. Lewis, R. P. Warren, B. F. Postman

TECHNICAL ADVISORY COMMITTEE ON INDUSTRIAL VENTILATION

The Technical Advisory Committee on Industrial Ventilation met at the Laboratory on the afternoon of September 16 under the chairmanship of W. N. Witheridge, and 10 members were present.

At the request of the Guide Publication Committee, members of this Committee have prepared revisions for Chapters 33 and 46 of THE GUIDE 1949, on Air Cleaning and Industrial Exhaust Systems.

AIR DISTRIBUTION STUDIES

The Technical Advisory Committee on Air Distribution, under the chairmanship of Ernest Szekely, held a meeting at the Research Laboratory on September 18, 1948, with 10 members of the Committee in attendance. The following studies under the direction of this Committee are now in progress and were reviewed:

1. Under a cooperative agreement with Kansas State College, a study is being made of the downward projection of heated air. This project was undertaken in 1945 to develop data on air distribution from downward projection type unit heaters. A paper on this work was presented at the 54th Annual Meeting.

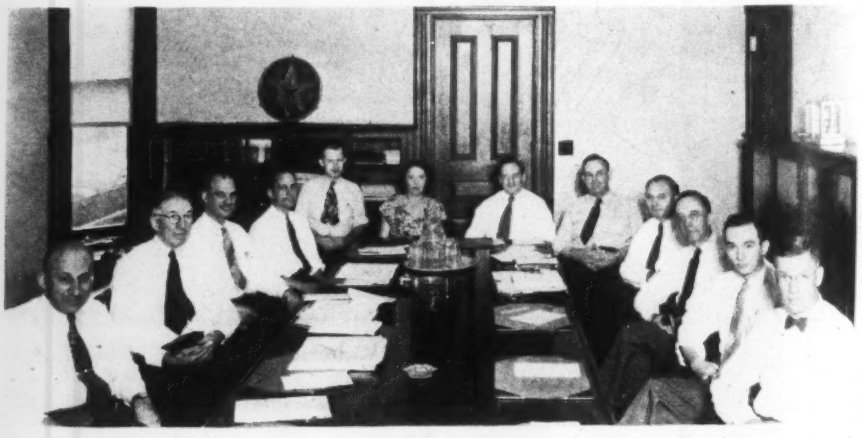
2. For a number of years a cooperative agreement has been in effect with Case Institute of Technology for the investigation of air distribution problems. Several papers have resulted from this work, the last of which, The Discharge of Air from a Long Slot, was presented at the 54th Annual Meeting. The study of slots is continuing, and an investigation of the performance of perforated ceilings is also being made.

3. A cooperative agreement with Michigan State College for the study of friction losses in branch take-off fittings has recently been signed. This project will be limited to rectangular ducts, and for the present at least, to 90 deg fittings. The purpose of this study is to develop data of a practical nature that may be readily applied to duct design problems.

4. An investigation of the performance of chilled air jets is being made at the Research Laboratory.

The first part of the program will include jets of various shapes and velocities discharging into free space. Later tests will be made to determine the modifying effects of nearby walls and ceilings. Instrumentation for this project makes it possible to determine not only the temperature and velocity distribution in the space, but also the turbulence created by the jet.

In addition to supervising the research program outlined, this Committee has prepared revisions for Chapter 41, on Air Duct Design, in THE GUIDE 1949.



Meeting of TAC on Air Distribution, September 18, 1948

(L. to R.) T. H. Troller, W. A. Pownall, W. B. Kirk, F. B. Holgate, C. M. Humphreys, Miss I. M. Jahn, Ernest Szekely, L. G. Miller, W. O. Huebner, J. N. Livermore, D. W. Locklin, R. D. Madison

NOMINEES FOR 1949 COMMITTEE ON RESEARCH

Three-Year Term

Irwin W. Cotton, Indianapolis, Ind., president, I. W. Cotton Co., was born September 23, 1887, at Greensboro, Ind. He attended Butler University and in 1908 received B.S. degrees from J. B. Stetson University and from the University of Chicago.

I. W. Cotton
Indianapolis, Ind.

In 1928 he became president and manager of the I. W. Cotton Co., Inc., heating and ventilating contractors, and is sole owner and manager. In 1942 he took a one year leave of absence from the company to become district fuel rationing officer, Indianapolis District, Office of Price Administration.

Since becoming a member of the Society in 1943, he has been active in the Indiana Chapter, having served as vice president in 1946, and as president in 1947. He is now serving on the board of governors and as chapter delegate.

Mr. Cotton is a member of the Indianapolis Air Conditioning Council and the Service Club of Indianapolis.

•

Nathaniel Glickman, Chicago, Ill., physiologist, Aero-Medical and Atmospheric Environment Unit, Department of Medicine, University of Illinois, was born in Chicago on September 23, 1911. He received his M.S. from the University of Illinois Medical School in 1936.

After receiving his degree, he became an assistant in physiology at that university where he also carried on full time research as an ASHVE Research Fellow. In 1942 he joined the staff at the University Medical School, first as chief physiologist on Office of Scientific Research and Development Contracts, and later as physiologist to Physical Environment Unit. In his present capacity, he is directing and conducting research on environmental physiology and on the effect of the environment on the human body.

Professor Glickman is the coauthor of a number of papers resulting from cooperative research at the University of Illinois Medical School which have been published by the Society.

Nathaniel Glickman
Chicago, Ill.

He joined the Society in 1948 and is serving as a member of the Guide Publication Committee.

He is also a member of the *American Physiological Society*, and Sigma Xi.

•

Walter A. Grant, Syracuse, N. Y., director of research, Carrier Corp., was born on August 27, 1904 in Brooklyn, N. Y. He is a graduate of Columbia University, receiving his A.B., B.S. and M.E. degrees in 1928.

In the same year, he became affiliated with the Carrier Engineering Corp., as a junior engineer specializing in air conditioning. He has subsequently served with the Carrier Corp. as an application engineer, development engineer, chief engineer of the Eastern Contracting Department and Eastern regional chief engineer.

W. A. Grant
Syracuse, N. Y.

He joined the Society in 1929 and is also a member of the *American Society of Mechanical Engineers.*

•

Louis N. Hunter, Johnstown, Pa., vice president and manager of research, National Radiator Corp., was born at Brampton, Ontario, Canada, August 27, 1903. He attended the University of Toronto, receiving his B.A. Sc. degree in 1925.

His first assignment was as assistant research engineer with the Bryant Heater Co., Cleveland, Ohio. In 1930, he became affiliated with the National Radiator Corp., Johnstown, Pa., as gas engineer, and in this capacity designed and tested gas-fired house heating boilers and controls. He also designed and tested special cast iron gas-fired boilers for treating crude oil emulsions. Two years later he was made assistant manager, research department, where he supervised the designing, testing, and research work on coal, oil and gas-fired boilers, oil burners, stokers, radiators, con-

vectors, and air conditioning equipment, accessories and controls. In 1935, he became manager of the research department and in 1941 was appointed to his present position as vice president and manager of research.

Mr. Hunter joined the Society in 1936 and is chairman of the Committee on Research and chairman of the current Research Executive Committee. He is also a member of the Society's Army Liaison Committee. He is also ex-officio member of the Society's Council for one year. In 1946 he was elected to serve a three-year term on the Committee

L. N. Hunter
Johnstown, Pa.

on Research. From 1939 to 1942 he served on several Technical Advisory Committees, including the TAC on Radiation and Comfort and the TAC on Solid Fuels. He is also serving on the TAC on Panel Heating and Cooling.

Mr. Hunter is listed in *Who's Who in Engineering*, is a member of ASME and the Susquehanna Country Club.

•

Richard D. Madison, Buffalo, N. Y., Research Engineer, Buffalo Forge Co., was born in Terre Haute, Ind., April 28, 1891. He attended Rose Polytechnic Institute, Terre Haute, receiving his B.S. in mechanical engineering in 1913.

Mr. Madison received his early training with the Hydraulic Press-Brick Co., and then joined Crawford and McCrimmon Co., both of Brazil, Ind. He was with William Seaver Morgan Co., Cleveland, Ohio, before

R. D. Madison
Buffalo, N. Y.

joining the staff of the U. S. Army Ordnance Department, Washington, D.C. During his four years association with Army Ordnance he was stationed at Sandy Hook, Peoria, Dayton, and Indianapolis.

In 1919 he joined the Buffalo Forge Co., where he became a research engineer. Mr. Madison joined the Society in 1926 and has been closely connected with its research work since that time. He has served for many years as a member of the Technical Advisory Committee on Air Distribution and Air Friction, as well as a member of the Technical Advisory Committee on Sound Control since 1941. He is an ex-officio member of the Publication Committee and is vice chairman of the Committee on Research, as well as vice chairman of its Executive Committee.

He also belongs to the *American Society of Mechanical Engineers* and the *Society of Automotive Engineers*.

Two-Year Term

Elmer R. Queer,* State College, Pa., professor of Engineering Research in charge of the Thermal Research Laboratory, Pennsylvania State College, was born on May 26, 1904, at Johnstown, Pa. He attended Pennsylvania State College, receiving his B.S. degree in electrical engineering in 1926 and his M.S. in 1928. While preparing for his M.S. he was an Elliot Research Fellow in the Engineering Experiment Station.

From 1928 until 1934 he was engaged in thermal research on building and insulating materials at the college. In 1934 he became an assistant professor in Engineering Research, where in addition to doing thermal research he conducted heat transmission tests on naval warship construction for the U. S. Navy. This comprised tests on about 125 ship panels. He developed means for measuring moisture vapor transmission through low temperature insulation and building materials. Called to active service in the Navy with the rank of Lt. (jg) in 1941, Professor Queer, after a tour of duty at sea, was stationed at the Bureau of Ships, Washington,

E. R. Queer
State College, Pa.

D. C., as executive officer to the officer-in-charge of the Air Conditioning Section. He received commendations from Admiral Nimitz for work in the Fleet early in the war and from the Secretary of the Navy for work in the Bureau of Ships. He was detached from active duty with the rank of Commander in 1946.

At the conclusion of the war, he returned to the Engineering Experiment Station, Pennsylvania State College to his present position.

Since joining the Society in 1933, he has submitted numerous papers for publication in the JOURNAL and TRANSACTIONS. He has also served on the Membership Committee and in 1947 was elected chairman of the Technical Advisory Committee on Insulation. He is at present serving as chairman of the Society's committee on Admission and Advancement.

Professor Queer is a member of the *Society of Naval Architects and Marine Engineers, U. S. Naval Institute*, and Sigma Xi fraternity.

* To fill two-year unexpired term.

Chicago to Have Biggest Meeting and Exposition

It is expected that the 55th Annual Meeting, to be held in Chicago, January 24-27, will be the largest in the Society's history and the Committee on Arrangements of the Illinois Chapter offers a warm welcome to the visiting members and ladies.

There will be five full days of technical and committee meetings and an entertainment program which will fill in some of the free time. Ample time will be provided for visiting the 9th International Heating, Ventilating and Air Conditioning Exposition at the International Amphitheatre where 300 manufacturers will display their products and equipment.

The technical sessions of the Society's meeting are scheduled for the Stevens Hotel and an early start will be made by the Committee on Research which will be called to order on Saturday morning, January 22. On Sunday, January 23, the Council will meet and registration of members and guests will begin.

Technical Sessions to Cover Many Subjects

The first session on Monday will be devoted to reports of officers and to two technical papers. This will be followed by a get-together luncheon at which Dr. Henry T. Heald, president of the Illinois Institute of Technology, will be the speaker.

Technical sessions will be held Tuesday morning, Wednesday morning and afternoon and Thursday morning. The tellers of election will report on Tuesday, and following the session, a luncheon will be held at which Cyril Tasker, director of research, will report on his observations on research in European countries.

Among the subjects to be discussed during the technical sessions will be physiological studies of environment, a cooperative research report on cooling tower performance and research Laboratory reports on air turbulence and overall coefficients for flat glass. Papers on air distribution, radiant heating and chimney performance are among those dealing with other subjects.

The Chapter Delegates will assemble for their conferences on matters affecting chapter operation and to choose seven members and an alternate for the Nominating Committee.

The Society's Past Presidents will hold their annual reunion and the crowning social function of the meeting will be the Annual Banquet on Wednesday night. John Howatt, past president of the Society, will be the toastmaster.

There will be a meeting of the Nominating Committee and organization meetings of the new Council and the Committee on Research.

A special Ladies Committee has been announced by C. M. Burnam, Jr., president of the Illinois Chapter. The chairman of this committee is Mrs. William A. Kuechenberg, and its secretary is Mrs. Chas. E. Price; its members are Mrs. Manuel J. Bamond, Mrs. M. W. Bishop, Mrs. George W. Bornquist, Mrs. C. M. Burnam, Jr., Mrs. Harvey G. Chapin, Mrs. Joseph S. Kearney, Mrs. Peter J. Marschall, and Mrs. James H. Milliken. A busy program for the ladies is being planned; featured will be many activities centering around the *Get-Together Lounge* in the headquarters hotel.

Already the volume of hotel reservations indicates an attendance from every area of the United States and Canada. A special train to the Chicago meeting is being arranged by the Texas Chapters and they will want you to come to Dallas in 1950.

Kaufmann & Fabry Co.

A number of activities for the ladies will be held in the Merchandise Mart

PROGRAM—55th ANNUAL MEETING

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Stevens Hotel — **Chicago, Ill.**

Saturday—January 22

10:00 a.m. Committee on Research Meeting

Sunday—January 23

10:30 a.m. Council Meeting

1:30 p.m. REGISTRATION

Monday—January 24

8:30 a.m. REGISTRATION

9:30 a.m. BUSINESS SESSION
- Greetings
- Reports of Officers and Council Committees

12:15 p.m. Welcome Luncheon—Speaker: Dr. Henry T. Heald, president, Illinois Institute of Technology

1:30 p.m. Chapter Delegates Meeting

9:00 p.m. Informal Party

Tuesday—January 25

9:00 a.m. REGISTRATION

9:30 a.m. TECHNICAL SESSION
- Report of Tellers of Election
- The Internal Performance of an Induced Draft, Packed Cooling Tower, by N. W. Snyder
- Heat Transfer Rates for Refrigerant Boiling in Horizontal Tube Evaporators, by L. G. Seigel, W. L. Bryan and M. C. Huppert

12:30 p.m. Luncheon Meeting—Speaker: Cyril Tasker, Director of Research, ASHVE

6:30 p.m. Past Presidents' Dinner

9:30 p.m. Chapter Delegates Meeting

Wednesday—January 26

9:00 a.m. REGISTRATION

9:30 a.m. TECHNICAL SESSION
- Are Automatic Air Shutters Justified on a Gas-Fired Conversion Burner? by W. M. Myler, Jr., and H. W. Nelson
- Performance of Fourteen Masonry Chimneys Under Steady State Conditions, by P. R. Achenbach and S. D. Cole
- Performance of Residential Chimneys, by L. B. Schmitt and R. B. Engdahl

2:00 p.m. TECHNICAL SESSION
- Performance of an Electrical System of Radiant Panel Heating with Four Stages of Insulation, by R. J. Lorenzi and J. F. Schreiber
- Heating A Basementless House With Radiant Baseboard, by R. H. Weigel and W. S. Harris
- Overall Coefficients for Flat Glass, Determined under Natural Weather Conditions, by G. V. Parmelee and W. W. Aubele

7:00 p.m. Annual Banquet—Toastmaster: John Howatt, past-president, ASHVE

Thursday—January 27

9:00 a.m. REGISTRATION

10:00 a.m. TECHNICAL SESSION
- Turbulence—A Fundamental Frontier in Air Distribution, by H. B. Nottage
- Adjustment and Balancing of the Air Delivery Through a System of Manifold Diffusers, by G. S. Dauphinee and Peter Argentieri
- Air Distribution and Draft, by John Rydberg and Per Norback
- Unfinished Business
- New Business
- Resolutions
- Installation of Officers
- Adjournment

12:30 p.m. Nominating Committee Luncheon

1:00 p.m. Council Luncheon Meeting

COMMITTEE ON ARRANGEMENTS

General Chairman—William A. Kuechenberg. *Vice Chairman*—James H. Milliken. *Honorary Chairmen*—Harry M. Hart, E. Vernon Hill, John Howatt, Samuel R. Lewis, A. C. Willard.

Banquet Committee—Harvey G. Chapin, *Chairman*, Manuel J. Bamond, *Co-Chairman*, C. H. Bevington, Charles W. De Land, Harry Himelblau, Wm. G. Hoskins, Charles R. Kuglin, Eugene Mathis, Orville Miller, Jr., Ralph A. Patterson, J. J. Philippi, S. I. Rottmayer, D. B. Scheidecker, John F. Tobin, Mel. J. Stevenson.

Entertainment Committee—Joseph S. Kearney, *Chairman*, W. H. Brackett, A. L. Crump, Matthew J. Fitzgerald, E. P. Heckel, Jr., A. O. May, Lawrence O. Paul, Leo J. Potvin, Chas. E. Price, Earl E. Sundeen, Harvey G. Swart.

Exposition Committee—George W. Bornquist, *Chairman*, Clarence C. Graves, A. Warren Lippitt, Robert V. Mehaffey.

Finance Committee— Peter J. Marschall, *Chairman*, Wm. F. Christmann, Harry E. Clo.

Ladies' Committee—Mrs. William A. Kuechenberg, *Chairman*, Mrs. Chas. E. Price, *Secretary*, Mrs. Manuel J. Bamond, Mrs. M. W. Bishop, Mrs. George W. Bornquist, Mrs. C. M. Burnam, Jr., Mrs. Harvey G. Chapin, Mrs. Joseph S. Kearney, Mrs. Peter J. Marschall, Mrs. James H. Milliken.

Publicity Committee—Oliver J. Prentice, *Chairman*, W. W. Gothard, Morley M. Hattis, Thomas V. Johnson, Geo. G. Turner.

Reception Committee—M. W. Bishop, *Chairman*, A. S. Ammerman, Jr., Harvey E. Anderson, Byron L. Casey, George B. Coffey, Henry J. Couch, Thomas Cranage, Chas. E. Crone, J. F. Cummiskey, E. B. Ericsson, James J. Hayes, Carl W. Johnson, Walter W. Lige, Albert B. Martin, James C. Matchett, James E. McClellan, E. N. McDonnell, Edward M. Mittendorff, Roy O. Nelson, H. J. Prebensen, Walter A. Stahl, Arthur G. Stout, Nils W. Swanson, M. J. Van Weelden.

Sessions Committee—George V. Zintel, *Chairman*, Russell H. Burgess, John H. Clarke, G. Gill Freyder, Harry G. Gragg, Herbert Kreisman, James W. Muessig, Roy W. Shields, Roland M. Spencer, Louis H. Streb, Conrad M. Vreuls, Vernon L. Wesby.

PERSONALS

Lee P. Hynes, a member of the ASHVE for over 29 years, has announced that the Hynes Electric Heating Co., Camden, N. J., has moved all of its specialized equipment and has transferred its trained personnel and the business operations of the company to the plant of Martin-Quaid Co., at 1815 W. Sedgley Ave., Philadelphia 32, Pa. Mr. Hynes will also continue private consulting practice at his present office in Camden, N. J., as consulting electrical and mechanical engineer.

G. Lorne Wiggs, Montreal, has announced that his firm of Wiggs, Walford, Frost & Lindsay, consulting engineers, whose main office is at Montreal, now has an office in the City of Toronto, located temporarily at 55 deVere Gardens.

ASRE ANNUAL MEETING IN DECEMBER

The 44th Annual Meeting of the *American Society of Refrigerating Engineers* will be held on December 5-8, 1948, at the Hotel Statler, Washington, D. C., according to an announcement by C. F. Holske, president of the Society.

Besides the technical papers on such subjects as food freezing, unusual refrigeration applications, etc., there will be a Domestic Refrigerator Forum. This innovation was first introduced at the Society's Spring Meeting this year where it met with unqualified success.

A full program of social and sightseeing activities has been planned by the Baltimore-Washington Section of *ASRE*, host for the meeting.

The nominees for 1949 officers are: *President*—B. H. Jennings, head, department of mechanical engineering, Northwestern University; *Vice Presidents* — J. G. Bergdoll, plant superintendent, York Corp.; and Edward Simons, consulting engineer, San Francisco; and *Treasurer*—P. B. Christensen, vice president Merchants Refrigerating Co.

HOPPER NEW DEAN AT NORTH TEXAS

J. S. Hopper, assistant dean of engineering and professor of mechanical engineering at Texas A. & M. College, has been named new dean of North Texas Agricultural College, Arlington, Tex., according to an announcement by E. A. Hereford, president.

J. S. Hopper

Dean Hopper received his B.S. in mechanical engineering from Texas Tech in 1933 and went to Texas A. & M. the same year as a graduate assistant. He received his master's degree from Texas A. & M. in 1936, and has been a full time member of the A. & M. faculty since 1935. He joined the ASHVE in 1939 and was instrumental in organizing the Texas A. & M. Student Branch in 1946. He is also a member of Tau Beta Pi, an honorary engineering fraternity.

FURBER IS CONGRATULATED

S. L. Furber of the Twin Cities sales staff, Minneapolis-Honeywell Regulator Co., and member of the ASHVE, received congratulations from the company officials after being awarded a two week's luxury cruise to Caribbean ports, in the Honeywell *Time to Climb* sales contest.

COUNCIL MEETS IN MEMPHIS

At a two-day meeting of the Society's Council at the King Cotton Hotel, Memphis, Tenn., a charter was granted for the formation of the Northeastern Oklahoma Chapter, with headquarters in Tulsa.

Reports were made by the Executive, Finance, Membership, Standards, Program and Papers Committees, and also the Committee on Research, Chapter Relations Committee, Constitution and By Laws and other special committees.

The 1949 budget was adopted covering general Society and reserve activities.

The selection of four members and an alternate to serve on the 1949 Nominating Committee was completed and approval was given to a new style of Student Membership application form, to the employment of a public relations counsel, and liquidation of the Laboratory mortgage on December 15. Action was taken to accept resignations and cancellations of memberships. All of the officers and all but four members of the Council were present.

Following the Council Meeting, the members and officers joined the Memphis Chapter for a dinner meeting and the speakers were President G. L. Tuve, Vice President Lester T. Avery, L. N. Hunter, chairman of the Committee on Research, and F. A. Hamlet, member of Council.

(l. to r.) **C. B. Sweatt, executive vice president, J. E. Haines, vice president in charge of the commercial division, Mr. Furber, and Thomas McDonald, vice president in charge of sales**

Summary of Local Chapter Meetings*

Atlanta—September 3, 1948. S. W. Boyd, chairman of the Code Committee, reported on a meeting at which he and Pres. L. L. Barnes discussed, with Paul Weir, head of the city Water Department, a proposed ordinance for air conditioning systems in the city. Mr. Boyd also reported on the status of the general air conditioning code for the city of Atlanta. After a report on the Semi-Annual Meeting at Bretton Woods, W. N. Pauley, chief engineer, Farr Co., Los Angeles, Calif., was introduced. He spoke on Theory and Practical Design of Air Filters, which was well received and an interesting discussion followed. Attendance 44.

•

Central New York—September 22, 1948. Pres. D. L. Mills presided at the first meeting of the 1948-49 season, held at the Howard Johnson Restaurant, DeWitt, N. Y., and presented past president emblems to C. M. Ashley, C. F. Woese and H. G. Strong. Following the introduction of the new officers, A. L. Jones, treasurer, reported on the total cash on hand. L. E. LaRow announced the programs scheduled for the year and called for suggestions from the floor. A lively debate followed as to the type of program desired.

J. P. Stewart, engineer, Carrier Corp., Syracuse, N. Y., presented excerpts from the paper he presented at the Society's Semi-Annual Meeting in Bretton Woods on solar heat gain, which aroused considerable interest and brought forth numerous questions in the discussion. At the conclusion of the discussion, a motion was made by H. K. Ormsby, seconded by Felix Laine, and passed, that V. S. Day, vice president of the Chapter, be named Chapter Delegate for 1948-49. Before adjournment, it was suggested that Dean L. E. Seeley be invited to speak at the Chapter's December meeting on the subject, *What Sort of Society Do We Want?* Attendance 41. Attendance ratio 0.31.

•

Delta—September 8, 1948. Following the preliminary reading of minutes and introduction of new members and guests, W. H. Grant, Jr., read a letter from Reg. F. Taylor, Houston, Tex., chairman of the Society's Chapter Relations Committee, giving statistics on membership of the Society, and then reported on the plans for vigorous activity by the Chapter's membership committee.

C. B. Gamble introduced the guest of the evening, T. H. Urdahl, consulting engineer, Washington, D. C., who addressed the meeting on Dehumidification for Preservation of Materials. He illustrated his talk with slides and concluded with a movie on the preservation of warships, which was produced by the U. S. Navy, Bureau of Ships. Mr. Urdahl answered many questions in the course of the discussion. It was suggested by Mr. Grant that Mr. Urdahl personally convey to the Shreveport Chapter the Delta Chapter's regrets for not having participated in its inaugural meeting. Attendance 59. Attendance ratio 0.53.

•

Golden Gate—September 2, 1948. R. B. Lundy, West Coast sales manager, Combustion Controls Corp., spoke on the subject, Safety With Electronics, in which he outlined the development of electronic tubes and their uses in counting mechanisms, sorters, smoke detection, control of illumination, combustion safeguards and other fields relative to mechanical engineering. Several working models supplemented his talk, and they proved to be of interest to the members, many examining them in detail after adjournment. J. E. Murray opened discussion on the professional engineer's status, with regard to the amount of State of California work to be sublet, and he was subsequently appointed special representative to the Technical Committee to make further investigations and to report back at the next meeting. Attendance 76.

•

Indiana—September 24. Immediately following dinner, W. R. Fenstermaker introduced Lester T. Avery, Cleveland, Ohio, second vice president of the ASHVE, who spoke first on the growth of the Society, explaining the reasons for increasing Society dues, before he gave his talk as speaker of the evening. Mr. Avery gave an extremely interesting discussion on Process Air Conditioning and its importance in producing many new products under controlled conditions. He stressed the fact that not only are temperature, humidity and air distribution important in air conditioning, but that the quality of the air is of the utmost importance in process work and will undoubtedly be so considered in comfort air conditioning in the very near future. At the conclusion of Mr. Avery's presentation, numerous questions were asked from the floor, primarily concerning the design of the systems, particularly with regard to the design of the perforated panel distribution ducts. Attendance 40.

•

Kansas City—September 14, 1948. Reports by various committee chairmen were given, and C. W. Schumacher, chairman of the membership committee, introduced Pro-

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

fessor Dash, head of the mechanical engineering department at the University of Kansas, who reported on the possibility of organizing a Student Branch at the University. He stated that definite action would be taken just as soon as the students returned to classes, and he pointed out that a student branch would need the assistance of the Kansas City Chapter members.

D. M. Allen, a member of the Society's Council, reported briefly on the Bretton Woods Meeting, followed by the introduction of the speaker of the evening, T. H. Urdahl, consulting engineer, Washington, D. C.

Mr. Urdahl gave an interesting talk in which he outlined problems of the Navy during the war in designing heating and ventilating systems for ships. He also described the development of several time-saving slide rules and outlined some of the standardization programs as applied to coils, fans, etc. Mr. Urdahl gave the impression that a possible way to reduce the amount of labor and material used in duct work and fans would be to use higher velocities. At the conclusion of his talk, he showed a Navy training film showing the procedure involved in dehydrating a ship for storage. Mr. Urdahl's talk aroused considerable interest and a lively discussion followed. Attendance 69. Attendance ratio 0.31.

•

Oklahoma—September 13, 1948. Oklahoma Chapter's first meeting was held at Beverly's Drive-In, where an excellent picture was put on by the U. S. Navy, in charge of Chief J. M. Wright. The picture showed our submarine forces in action on the Japanese coast during World War II. Mr. Wright also presented a short picture which dealt with Admiral Byrd's latest expedition to the Antarctic. This latter picture dealt mostly with the testing of various types of war equipment including tanks and airplanes. Following the showing of the movies, there was a short discussion as to changing the meeting night of the Oklahoma Chapter to fit in with the meeting night of the North Texas Chapter and the new Northeastern Oklahoma Chapter. This, it was thought, would be more beneficial to all concerned. K. B. Randleman was appointed to contact the other chapters and he will report at the next meeting. Attendance 42.

•

Oregon—September 9, 1948. Pres. E. R. Lokey called on J. P. McDermott to introduce the guest of the evening, Frank Roehr, president of the Oregon Chapter of the *American Institute of Architects*. Mr. Roehr, who spoke on the subject, *An Architect's Slant on the Heating Industry*, complimented the engineering societies for their practice of conducting educational meetings and technical conferences, and announced that the architects were now following suit. He pointed out the greatly improved practice of both engineers and architects of writing open specifications and commented that cooperation between architects and engineers is now the rule rather than the exception. He brought out the present high cost of all construction, urging all professions and trades to cooperate to keep housing costs to a practical minimum. He expressed the need for low cost heating plants for small homes and expressed the opinion that possibly the heating equipment industry should encourage small home owners to install the most simple heating system; providing, however, for installing additional desirable features and/or controls at a later, financially convenient date. He mentioned the detail that present day specifications provide, admitting that there are still too many instances where poor documents are costing the home owner additional expense. He requested that such instances be brought to the attention of the *AIA* Oregon Chapter officers in order that such poor practice can be curbed. A question and answer period followed Mr. Roehr's presentation, after which the regular business of the Chapter was attended to. Attendance 68. Attendance ratio 0.40.

St. Louis—September 14, 1948. The first meeting of the season was designated as Ladies Night and a welcoming address was given by Pres. B. L. Evans. J. H. Carter, member of an investigating committee of the Joint Council of Engineers of St. Louis, announced that the committee was studying conditions of the Engineers' Society and would report later. After a short recess, W. A. Russell, chairman of the meetings committee, introduced the speaker of the evening, Ross C. Shannon, sales manager, Socony Vacuum Oil Co., and president of the Sales Managers Bureau of the St. Louis Chamber of Commerce, who made a very interesting and entertaining talk on *Why Sell*. At the conclusion of Mr. Shannon's talk, President Evans presented Past Presidents with a token of appreciation, and W. A. Klein made a short acceptance talk representing the Past Presidents. Attendance 71.

•

Shreveport—August 19, 1948. After reports by committee chairmen, H. E. Degler, Marley Co., Kansas City, Kan., was introduced. He spoke on the design and application of cooling towers. A. H. Otto, chairman of the Meetings Committee announced that T. H. Urdahl, consulting engineer, Washington, D. C., would speak at the September meeting. His subject will be Weather Design Factors Affecting the Success and Economy of Heating and Air Conditioning Systems. Attendance 40.

•

South Texas—August 20, 1948. H. E. Degler, Marley Co., Kansas City, Kan., spoke on Water Cooling Towers for Air Conditioning and Refrigeration, with a preface explaining the critical state of the water supply in many parts of the United States. His talk, which was illustrated with slides, dealt with the various types of cooling towers and the development of the modern tower. Hollis DeVines presented Past President's pins to Reg. F.

Taylor, C. A. McKinney, A. J. Rummel, A. F. Barnes, J. A. Walsh, B. P. Fisher, and D. M. Mills. Pres. C. C. Quin announced that G. L. Tuve, Cleveland, Ohio, president of the Society, will be in Houston, November 11. Attendance 44.

•

Virginia—September 22, 1948. J. E. White, acting president, summarized the activities of the Board of Governors during the summer, and announced that J. F. Boyenton was appointed to serve as a member of the Board of Governors for the remainder of the year, replacing W. H. Webster, Jr. It was then announced that D. E. Phillips would be the Chapter Delegate for 1949. Mr. Boyenton introduced the speaker of the evening, G. W. Hallam, Minneapolis - Honeywell Regulator Co., Richmond, Va., who addressed the meeting on the subject of Controls and their Application. He spoke in detail of the application and advantages of temperature controls. He cited an example wherein it has been extremely advantageous to purchase elaborate and costly equipment to relieve fatigue conditions and, thus, help to eliminate the possibility of human error. He pointed out that equipment should be chosen carefully, with all requirements weighed as to desired results, dependable service, efficiency, accuracy, cost of maintenance, and justification of the decision that automatic controls are an advantage in a particular plant or operation. Many questions and answers carried the group into a lengthy and interesting discussion. Following the discussion, R. C. Thomas was presented with a Past President's pin, which came as a complete surprise to Mr. Thomas. Attendance 23.

•

Wisconsin—September 20, 1948. Pres. W. A. Ouweneel opened the first meeting of the season and called on R. D. Rodwell, chairman of the program committee, who reported on the programs for the forthcoming meetings. J. A. Lofte, chairman of the membership committee, reported that the chapter roll consisted of 99 members, with a quota set for 20 new members for the year. Ernest Szekely reported for the building code committee and stated that the fifteenth draft of the new Code for Milwaukee is now in the hands of the committee.

The guest speaker of the evening, V. M. Lathers, engineer, Barber-Colman Co., Rockford, Ill., was then introduced, and he gave a talk on Engineered Air Distribution. He covered the subject in a fundamental, but thorough manner. Starting with airflow and air measuring instruments he touched upon the fundamentals of air distribution, contours of grilles and the necessity of large aspect ratios, grille discharges and throws, louvers and turning vanes, and proper selection of grilles. Many of the illustrations used by Mr. Lathers, dealt with smoke tests, verifying different points as brought out in his talk. The meeting was adjourned following a standing vote of thanks to Mr. Lathers. Attendance 61. Attendance ratio 0.34.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 65 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by November 25, 1948, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

ACHESON, M. W., III, Pres., Bossi & Co., Inc. PROPOSERS: H. F. Eastwood, H. D. Merrill*. SECONDERS: J. F. Fisher*, H. C. Sawyer.

ALBRECHT, R. A., JR., Sales Engr., Sheet Metal Engineering & Air Conditioning Co. PROPOSERS: G. V. Sutfin, E. W. McNamee. SECONDERS: K. A. Wright, T. D. Reiley.

ALLSOP, R. P., Consulting Engr. (*Advancement*). PROPOSERS: H. R. Roth, V. J. Jenkinson. SECONDERS: D. A. Stott, E. G. Spall.

ASH, ROBERT S., Buyer, Montgomery Ward & Co. (*Advancement*). PROPOSERS: A. B. Martin, L. D. Mandell, Jr. SECONDERS: O. J. Prentice, C. M. Burnam, Jr.

ASMUS, HOWARD P., Asst. Dist. Repr., Warren Webster & Co. PROPOSERS: Edwin Woolcock, Joseph Davis. SECONDERS: J. H. Bryce, T. F. Killeen.

BALDWIN, H. KRIETE, Sales, Utility Appliance Corp. PROPOSERS: Leo Hungerford, R. A. Lowe. SECONDERS: R. M. Storms, Maron Kennedy.

BAUER, EUGENE F., Owner, Automatic Water Heater Service Co. PROPOSERS: R. L. Byers, E. E. Maurer. SECONDERS: B. E. Mastee*, P. B. Howard*.

BECKERMANN, CHARLES A., Vice-Pres., Sodemann Heat & Power Co. PROPOSERS: E. T. Clucas, B. C. Simons. SECONDERS: M. F. Carlock, G. A. Langenberg.

BOCKSEL, L. L., Radiant Htg. Engr., Chase Brass & Copper Co. PROPOSERS: S. R. Osborne, R. L. Maher. SECONDERS: R. W. Sidbury, E. C. Marsden.

BOSS, HERBERT E., Mech. Engr., Aerofin Corp. PROPOSERS: Milner Noble, L. A. Childs. SECONDERS: L. H. Fritzberg, W. E. Heibel.

*Non member

BOWMAN, CALVIN E., Standard Roofing and Material Co. PROPOSERS: John H. Spaan, Jr., G. T. Donceel. SECONDERS: F. X. Loeffler, Jr., J. R. Patten.

BROWN, LESLIE S., Mech. Engr., Bell Telephone Co. of Canada. PROPOSERS: J. R. Petrinec, D. A. Stott. SECONDERS: H. R. Roth, E. R. Turnbull.

BRYNGE, P. GUNNAR, A. B. Enkopings Verkstader. PROPOSERS: E. F. Snyder, J. E. Haines. SECONDERS: Martin Edman*, C. W. Nessell.

BURT, STANLEY H., S. H. Burt, Sales & Engrg. PROPOSERS: D. E. Sedgwick, O. L. Lilja. SECONDERS: H. J. Sewell*, A. D. Cole.*

CAMPBELL, FRANK W., Student, Purdue University. PROPOSERS: W. T. Miller, F. B. Morse. SECONDERS: C. W. Messersmith*, H. G. Venemann*.

CARTER, ROBERT C., Engr. in charge Bldg. Services, Stone & Webster Engineering Corp. PROPOSERS: R. H. Cutting, W. H. Silk. SECONDERS: A. S. Ciresi*, H. L. Repp.

COLBERT, FRED, Mfrs. Agent. PROPOSERS: W. R. Lee, L. S. Reagan. SECONDERS: G. C. Bergtholdt, Edwin Jones.

CRICHTON, GEORGE A., Asst. Field Engr., Iron Fireman Mfg. Co. of Canada, Ltd. PROPOSERS: M. M. Todd, W. R. Blackhall. SECONDERS: D. R. Steeves, H. S. Moore.

CHRISTMAN, THEODORE P., Jr. Engr., Air Conditioning, Inc. PROPOSERS: L. S. Pawkett, R. W. Barnes. SECONDERS: K. J. Monier, F. C. Benham, Jr.

DAVID, JOSEPH M., Lewie David. PROPOSERS: J. R. Carroll, Jr., R. J. Martin*. SECONDERS: H. D. Bareither, J. C. Miles*.

DINSMORE, RALPH E., Estimator, Rustad Htg. & Plbg. Co. PROPOSERS: E. J. Rosen, M. N. Musgrave. SECONDERS: R. O. Wesley, D. O. Mead.

DOAN, DOUGLAS, Gen. Mgr. & Chief Engr., Kirby Hammond, Inc. PROPOSERS: R. A. Stipp, V. D. Ramseur, Jr. SECONDERS: R. K. Rouse, G. R. Morgan.

ECHOLS, D. L., Treas., Matthews Engineering Co. PROPOSERS: R. R. Matthews, C. A. Barbeck. SECONDERS: S. S. Brandt, W. R. Barbeck.

ENGLISH, A. L., Owner, The A. L. English Heating & Air Conditioning Co. PROPOSERS: A. R. Curtis, R. H. East. SECONDERS: E. V. Gritton, S. J. Jespersen.

FREEMAN, F. W., Mech. Designer, Patchen and Zimmerman, Engrs. PROPOSERS: L. F. Lawrence, Jr., C. A. Spears, Jr. SECONDERS: F. S. Whitehouse*, H. F. Zimmerman*.

FURNISS, RICHARD A., Gen. Mgr., Page Air Conditioning Co., Inc. PROPOSERS: W. M. Wallace, II, E. C. Jones. SECONDERS: C. Z. Adams, R. E. Mason.

GALL, FRANK, Sales Engr., Bell & Gossett Co. PROPOSERS: R. E. Moore, C. E. Pullum. SECONDERS: E. J. Gossett, H. A. Lockhart.

GIBSON, A. C., Mgr., Industrial Power Dept., Nashville Electric Service. PROPOSERS: Foskett Brown, W. C. Armistead. SECONDERS: J. M. Gallagher, Jr., W. F. Swats, Jr.

GILMAN, STANLEY F., Special Research Asst., University of Illinois. PROPOSERS: S. Konzo, R. J. Martin.* SECONDERS: R. L. Porter*, R. M. Wright*.

GRITTANI, H. R., Jr. Draftsman, The Trane Company of Canada, Ltd. PROPOSERS: J. W. O'Neill, H. M. Treleaven. SECONDERS: A. M. Dion, S. A. Jennings.

HALSEY, A. E., Designer-Draftsman, Engrs. Dept., Metropolitan Police, New Scotland Yard. PROPOSERS: M. B. Eamer, C. A. Suckan*. SECONDERS: S. H. Griffin*, R. E. Hughes*.

HASSO, DANIEL B., Hasso Brothers. PROPOSERS: H. H. Koster, J. W. Booker. SECONDERS: R. D. Myers*, L. J. Hodgins*.

HERRING, TOM N., Engr., Modern Supply Co. PROPOSERS: R. L. Cook, C. A. McKinney. SECONDERS: W. M. Lippert, C. G. Crocker.

JACK, NEIL T., Sales Engr., W. Jack Refrigeration & Air Conditioning Co. PROPOSERS: R. H. Fitzsimons, D. B. Thomas*. SECONDERS: N. H. Kangas, J. W. Powlesland.

JENSEN, M. R., Mech. Engr., Hitchcock & Estabrook, Cons. Engrs. PROPOSERS: F. F. Lange, J. B. Estabrook*. SECONDERS: L. C. Gross, G. A. Marin*.

KANTER, PINNEY, Owner, Four Way Ventilating Co. PROPOSERS: L. S. Pawkett, R. W. Barnes. SECONDERS: K. J. Monier, F. C. Benham, Jr.

KORAN, STEPHEN, E., Sales Engr., United States Radiator Corp. PROPOSERS: D. O. Mead, R. H. Liniger. SECONDERS: L. J. Harrington, N. W. Wilson.

LANKOW, HELEN P., Student, Oregon State College. PROPOSERS: J. D. Kroeker, R. C. Chewning. SECONDERS: J. H. Bonebrake, R. W. Peterson.

LEE, W. R., Bldg. Supt., Southwestern Art Association. (*Advancement*). PROPOSERS: F. M. Thomas, A. D. Holmes. SECONDERS: R. W. Winget, Frank McPherson*.

LEVASSEUR, ALBERT R., Owner, Albert R. LeVasseur. PROPOSERS: R. M. Ripley, S. R. Osborne. SECONDERS: W. O. Mosher, Winfield Roeder.

LOONEY, H. W., Vice-Pres., Looney's Sheet Metal, Inc. PROPOSERS: W. R. Lee, C. J. Kesseler. SECONDERS: A. D. Holmes, F. M. Thomas.

MARBARGER, JOHN P., Research Director, Physical Environment Unit, University of Illinois. PROPOSERS: R. W. Keeton, M. K. Fahnestock. SECONDERS: E. P. Heckel, Nathaniel Glickman.

MCCARY, RICHARD F., Sales Engr., E. L. Luke & Co. PROPOSERS: L. S. Pawkett, R. W. Barnes. SECONDERS: K. J. Monier, F. C. Benham, Jr.

MCCLENAHAN, JAMES W., Secy.-Treas., Macnsons Contracting Engrs. PROPOSERS: J. L. Rumsey, J. E. Murray. SECONDERS: R. C. Cushing, J. E. Marshall.

MCELROY, GEORGE E., Supervising Engr., Mine Ventilation Section, Health Branch, U. S. Bureau of Mines. PROPOSERS: A. C. Fieldner, Ernest Szekely. SECONDERS: C. M. Humphreys, R. D. Madison.

MCMULLEN, JAMES M., Gen. Mgr., American Air Conditioning Corp. PROPOSERS: D. R. Groth, E. W. Gray. SECONDERS: K. L. Sain, J. H. Spaan.

OTIS, CARL K., Secy., Joseph Davis, Inc. PROPOSERS: J. H. Bryce, Joseph Davis. SECONDERS: F. J. Weber, E. P. Brown.

PAGE, HENRY D., Engr., Dept. of the Army, Corps of Engineers. PROPOSERS: D. W. Davis, Jr., C. H. Amundson. SECONDERS: Ernest Szekely, E. W. Gifford.

PATERSON, J. A., Sales Engr., Railway & Engineering Specialities, Ltd. PROPOSERS: J. J. Lawlor, E. C. Ryon. SECONDERS: J. J. Foley, A. Nearingburg.

POTTER, C. WESLEY, Mine Ventilation Engr., Homestake Mining Co. PROPOSERS: C. W. Laws, F. R. Monick. SECONDERS: C. F. Smith, Jr., R. R. Pullen*.

PRATT, JOHN N., Engr., Kampfer Appliance. PROPOSERS: W. C. Baker, E. C. Willey. SECONDERS: S. H. Graf*, Louis Slegel*.

RAMBO, ALBERT L., C. Boynton Cole, Contracting Engr. PROPOSERS: J. E. Hannum*, C. R. Hixon*. SECONDERS: Y. A. Elizondo*, J. C. McKinnon*.

REAGER, E. R., JR., E. R. Reager Plumbing & Heating Co. PROPOSERS: M. M. Bolstad*, F. E. Ince. SECONDERS: E. C. Kuntz, C. H. Burnap.

RIEHL, CHARLES F., Engrg. Draftsman, Reg. F. Taylor, Cons. Engr. PROPOSERS: R. F. Taylor, R. J. Salinger. SECONDERS: H. L. DeVines, R. R. Kriechbaum.

RITTER, HENRY H., Mgr. Engrg. Dept., Baber's. PROPOSERS: E. J. Kearby, W. E. FitzGerald. SECONDERS: O. H. Atkins, M. E. Phillips*.

ROBERTSON, WILLIAM G., JR., Engr., Henry Adams, Inc. PROPOSERS: E. L. Crosby, E. H. Taze. SECONDERS: H. D. Glaser, E. R. Kent.

STAMM, RICHARD H., Jr. Htg. Engr., Crane Co. PROPOSERS: T. S. Jones, K. M. Stevens. SECONDERS: C. W. Schumacher, D. M. Allen.

THOMAS, DONALD B., Mgr., Air Cond. Div., Canadian General Electric Co. Ltd. PROPOSERS: A. J. Dickey, M. F. Thomas. SECONDERS: J. W. Powlesland, H. R. Roth.

*Note: member

TUMILITY, JACK E., Chief Engr., American Air Conditioning Corp. PROPOSERS: D. R. Groth, E. W. Gray. SECONDERS: K. L. Sain, J. H. Spaan.

VARRENDER, ALEXANDER C., Acting Mgr., Domestic Htg. Section, Canadian General Electric Co. Ltd. PROPOSERS: A. H. Hills, J. W. Powlesland. SECONDERS: H. R. Roth, W. McLean*.

*Non member

WEILER, S. I., Partner, Southwest Weathermakers, Inc. PROPOSERS: W. R. Lee, Frank McPherson. SECONDERS: Boyd Purifoy, J. C. Penafeather.

WHITTINGTON, DICK W., Pres., Whittington Pump & Engineering Corp. PROPOSERS: C. R. Ammerman, I. W. Cotton. SECONDERS: William Dwyer, T. R. Davis.

WILLIAMS, JOHN H., Student, Temple University. PROPOSERS: A. M. Smith, J. S. Newton*. SECONDERS: R land Hamel*, W. C. Setzer*.

WISSMILLER, V. DALE, Supervisor Refrigeration & Natl. Accts, Minneapolis-Honeywell Regulator Co. PROPOSERS: J. E. Haines, E. F. Snyder. SECONDERS: J. S. Locke, M. R. Eastin.

WOHLRAB, HARRY A., JR., Owner, Harry A. Wohlrab. PROPOSERS: A. M. Smith, W. C. Setzer*. SECONDERS: M. P Jacobs*, J. Newton*.

OBITUARIES

Joseph K. Goundie—Word has been received at Society headquarters office of the death on August 12, 1948, of Joseph K. Goundie, engineer with the Fritch Coal Co., Bethlehem, Pa.

Mr. Goundie was born at Lebanon, Pa., on December 29, 1889. He attended the Allentown Preparatory School and Lehigh University, from which he received a degree as engineer of mines in 1927. In 1929 he became fuel engineer for the Brown-Borhek Co., Bethlehem. After three years he joined the staff of the Fritch Coal Co. as sales engineer in charge of surveys, selection of equipment, laying out and supervising installations, which position he held until his death. He joined the Society in 1938.

Walter Knox, well-known engineer in the stoker industry, died suddenly, on August 19, 1948, while on a business trip at Savanna, Ill At the time of his death, he was associated with the Rheem Mfg. Co., Chicago, Ill.

Mr. Knox, who was born in Morrison, Ill., on July 1, 1900, attended the University of Illinois where he received his A.B. in 1923 and his B.S. in 1934. Following a few years with the Stoker Division of Fairbanks, Morse & Co., Chicago, Ill., with the Whiting Co., Harvey, Ill., and Armour Institute, Mr. Knox joined the Koppers Co., Pittsburgh, Pa., as director of its Stoker Laboratory. Here he gained his reputation as one of the country's best informed men on stoker operation and design. He was later with H. D. Conkey Co., Mendota, Ill., and the Morse Chain Co., Detroit, Mich.

A member of the Society since 1943, Mr. Knox also belonged to the *AIME*, the Coal-Heat Club of Chicago, the American Legion and had been a member of the engineering committee of the *Stoker Manufacturers Association*.

Louis F. Nordine, president of the Warren Plumbing & Heating Corp., Front Royal, Va., passed away suddenly on June 7, 1948. He had been a member of the Society since 1914. He took an active interest in the affairs of the Washington, D. C. Chapter of the Society and served as its secretary in 1937.

A native of Lake City, Minn., Mr. Nordine was born on Oct. 19, 1884. He attended Lake City High School and the University of Minnesota.

Before joining the Warren Plumbing & Heating Corp., Mr. Nordine was with the Andrews Heating Co., Minneapolis, the Herman Nelson Corp., Moline, Ill., the Minneapolis-Honeywell Regulator Co., Minneapolis, and The Trane Co.'s, Washington, D. C. office.

Gordon N. Sale, Toronto, Ont., died suddenly at his home on September 21, after suffering a cerebral hemorrhage. Mr. Sale, prominent in the compressed gas industry, was at his desk on the day before. He was in his 38th year.

Mr. Sale had been associated with Dominion Oxygen Co., Ltd., since 1939 and two years ago was appointed manager of process service. He was widely known throughout Canada in many industries because of his work on oxy-acetylene welding and cutting processes.

He was born in Toronto on November 6, 1911, and attended Parkdale Collegiate School and the University of Toronto. He was a member of the old Parkdale Canoe Club and Island Aquatic Club and participated in many regattas throughout Canada.

Besides being a member of the ASHVE, he was also a member of the *American Society for Metals* and the *Canadian Welding Society*, and a member of St. Paul's Kingsway Anglican Church.

He leaves his wife, the former Rheta Elizabeth Fox; two sons, Gordon N. G. Sale and Digby Graham Sale; a daughter, Joanna Elizabeth Sale; his mother, Mrs. G. N. Sale, Toronto, and a sister, Mrs. C. F. Burk, Talara, Peru.

John H. Waterman—The Society has learned with regret of the passing on August 27, 1948, of John H. Waterman, Boston, Mass., a Life Member of ASHVE. He was 81 years old and had been associated with Charles T. Main, Inc., since 1919.

Born in Boston, Mass., in 1867, he attended the Boston English High School. His first job was with Thomson-Houston Elec. Co. in the construction department. He later served as engineer with United Electric Securities Co., Planters Compress Co., Allis-Chalmers Mfg. Co. and the Light, Heat and Power Corp. During World War I, he was with the United States War Industries Board.

Mr. Waterman, who joined the Society in 1931, was also a member of *ASME* and *AIEE*.

Officers

President.....G. L. TUVE *Treasurer*.....L. E. SEELEY
First Vice Pres...A. E. STACEY, JR. *Secretary*.....A. V. HUTCHINSON
Second Vice Pres..LESTER T. AVERY *Technical Secretary*.CARL H. FLINK
Assistant to the President.....C. A. MCKEEMAN

Council

G. L. TUVE, *Chairman* A. E. STACEY, JR., *Vice Chairman*

Three Years: D. M. ALLEN, F. A. HAMLET, C. S. LEOPOLD, H. E. SPROULL.

Two Years: M. W. BISHOP, CARL F. BOESTER, LEO HUNGERFORD, R. F. TAYLOR.

One Year: E. G. CARRIER, F. W. HUTCHINSON, R. A. SHERMAN, B. M. WOODS, M. S. WUNDERLICH, L. N. HUNTER, *Ex-Officio.*

Council Committees

Executive—G. L. TUVE, *Chairman*; LESTER T. AVERY, A. E. STACEY, JR., L. E. SEELEY, *Ex-Officio.*

Finance—R. A. SHERMAN, *Chairman*; LESTER T. AVERY, C. S. LEOPOLD, L. E. SEELEY, *Ex-Officio.*

Program and Papers—A. E. STACEY, JR., *Chairman*; M. W. BISHOP, F. W. HUTCHINSON.

Membership—R. F. TAYLOR, *Chairman*; E. G. CARRIER, LEO HUNGERFORD.

Standards—M. S. WUNDERLICH, *Chairman*; D. M. ALLEN, C. F. BOESTER.

Advisory Board

Baldwin M. Woods, *Chairman*; Homer Addams, M. F. Blankin, W. H. Carrier, S. E. Dibble, S. H. Downs, W. H. Driscoll, E. O. Eastwood, W. L. Fleisher, H. P. Gant, F. E. Giesecke, E. Holt Gurney, L. A. Harding, H. M. Hart, C. V. Haynes, E. Vernon Hill, John Howatt, D. D. Kimball, G. L. Larson, S. R. Lewis, J. F. McIntire, Alfred J. Offner, F. B. Rowley, A. C. Willard and C.-E. A. Winslow.

Chapter Delegates Committee 1948

CHAPTER	DELEGATE	ALTERNATE
ATLANTA	L. L. Barnes	Leo Sudderth, Jr.
CENTRAL NEW YORK	D. L. Mills	C. O. Mackey
CENTRAL OHIO	H. R. Allonier	W. M. Myler, Jr.
CINCINNATI	H. K. Jennings	M. E. Mathewson
CONNECTICUT	S. R. Osborne	Winfield Roeder
DELTA	J. S. Burke	L. R. Maxwell
GOLDEN GATE	John Everetts, Jr.	N. H. Peterson
ILLINOIS	W. A. Kuechenberg	C. M. Burnam, Jr.
INDIANA	I. W. Cotton	G. B. Supple
IOWA	C. A. Wheeler	D. C. Murphy
KANSAS CITY	H. E. Gould	Henry Nottberg, Jr.
MANITOBA	D. S. Swain	Einar Anderson
MASSACHUSETTS	Adolph Ehrenzeller	R. T. Kern
MEMPHIS	E. E. Scott	
MICHIGAN	E. F. Hyde	
MINNESOTA	L. C. Gross	B. F. McLouth
MONTREAL	T. H. Worthington	Leo Garneau
NEBRASKA	K. R. Magarrell	K. E. Martin
NEW YORK	M. C. Giannini	A. A. Bearman
NORTH CAROLINA	E. S. deWitt	DeParx Stimson
NORTH TEXAS	C. R. Gardner	G. A. Linskie
NORTHERN OHIO	W. R. Moore	L. S. Ries
OKLAHOMA	G. T. Donceel	E. T. P. Ellingson
ONTARIO	W. W. Miller	A. J. Strain
OREGON	J. P. McDermott	B. W. Farnes
PACIFIC NORTHWEST	L. L. Bysom	J. D. Sparks
PHILADELPHIA	J. O. Kirkbride	E. K. Wagner
PITTSBURGH	B. B. Reilly	C. H. Schneider
ROCKY MOUNTAIN	H. H. Herman	D. J. McQuaid
ST. LOUIS	G. W. F. Myers	B. L. Evans
SHREVEPORT	A. H. Otto	
SOUTH TEXAS	D. M. Mills	C. C. Quin
SOUTHERN CALIFORNIA	R. A. Lowe	R. S. Farr
SOUTHWEST TEXAS	G. R. Rhine	I. W. Wilke
UTAH	C. E. Ferguson	E. V. Gritton
VIRGINIA	D. E. Phillips	
WASHINGTON, D. C.	H. H. Hill	A. S. Gates, Jr.
WESTERN MICHIGAN	H. R. Limbacher	C. H. Pesterfield
WESTERN NEW YORK	Roswell Farnham	Edwin Woolcock
WISCONSIN	R. D. Rodwell	J. R. Vernon

Special Committees

Admission and Advancement—E. R. Queer, *Chairman*: T. F. Rockwell (*two years*), L. S. Ries (*three years*).

Army Liaison—R. A. Sherman, *Chairman*; Lester T. Avery, L. N. Hunter, H. King McCain, S. C. Rothman, A. E. Stacey, Jr., T. H. Urdahl.

ASHVE *Code for Testing Heavy Duty Furnaces*—E. K. Campbell, *Chairman*; Bowen Campbell, R. S. Dill, F. A. Kitchen, A. P. Kratz, W. J. MaGirl, B. F. McLouth, F. L. Meyer, F. J. Nunlist, A. A. Olson, B. B. Reilly, Dr. H. J. Rose, H. A. Soper.

Chapter Relations—D. M. Allen, *Chairman*; C. Z. Adams, C. S. Koehler, J. Donald Kroeker, C. H. Pesterfield, W. F. Ryan, D. A. Stott.

Constitution and By-Laws—S. H. Downs, *Chairman*; John James, H. E. Sproull.

Guide Publication—R. C. Cross, *Chairman*; A. B. Algren, R. L. Byers, R. P. Cook, Nathaniel Glickman, B. H. Jennings, H. R. Limbacher, W. M. Wallace, II, W. N. Witheridge, Cyril Tasker, *Ex-Officio.*

Nominating—J. E. Haines, Minneapolis, Minn., *Chairman*, R. H. Carpenter, New York, N. Y., *Vice Chairman*; F. C. McIntosh, Pittsburgh, Pa., *Secretary*; C. M. Ashley, Syracuse, N. Y., Leo Garneau, Montreal, Que., Canada; John James, Chicago, Ill.; G. W. F. Myers, St. Louis, Mo.; G. B. Supple, Indianapolis, Ind.; Art Theobald, Los Angeles, Calif.; W. M. Wallace, II, Durham, N. C. *Alternates:* H. King McCain, Atlanta, Ga., and D. M. Mills, Houston, Tex.

Publication—John James, *Chairman*; R. S. Dill, S. S. Sanford, R. D. Madison, *Ex-Officio.*

Publication Policy—Lester T. Avery, *Chairman*; R. S. Dill, John James, L. N. Hunter, L. P. Saunders.

Public Relations—M. F. Blankin, *Chairman*; J. S. Locke, C. E. Price, K. C. Richmond, T. H. Urdahl, B. M. Woods.

Research Promotion—J. E. Haines, *Chairman*; W. E. Heibel, A. J. Hess, C. E. Price, D. L. Taze.

Committee on Research

ASHVE Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio (Tel.: EXpress 6161)

L. N. HUNTER, *Chairman* R. D. MADISON, *Vice Chairman*
CYRIL TASKER, *Director of Research* A. C. FIELDNER, *Ex-Officio*

Executive Committee: L. N. Hunter, *Chairman*; R. D. Madison, *Vice Chairman*; L. G. Miller, L. P. Saunders, W. E. Zieber.

Three Years: A. B. ALGREN, M. C. GIANNINI, C. W. JOHNSON, E. R. QUEER, W. E. ZIEBER.

Two Years: R. C. CROSS, M. K. FAHNESTOCK, JOHN JAMES, F. J. KURTH, T. H. URDAHL.

One Year: L. N. HUNTER, C. O. MACKEY, R. D. MADISON, L. G. MILLER, L. P. SAUNDERS.

Technical Advisory Committees 1948

Air Cleaning: R. S. Dill, *Chairman*; L. L. Dollinger, Jr., O. C. Eliason; R. S. Farr, C. D. Graham, A. B. Hubbard, R. E. Hunsaker, D. L. Hunzicker, J. W. May, K. W. MacKenzie, R. H. Mills, G. W. Penney, L. P. Saunders*, R. P. Warren, R. D. Wood.

Air Distribution: Ernest Szekely, *Chairman*; N. E. Berry, R. M. Conner, S. H. Downs, F. B. Holgate, F. J. Kurth*, J. N. Livermore, R. D. Madison*, G. E. McElroy, L. G. Miller*, D. W. Nelson, G. B. Priester, T. H. Troller.

Air Sterilization: W. F. Wells, *Chairman*; W. T. Anderson, Jr., L. J. Buttolph, C. W. Flood, Jr., Leonard Greenburg, M.D., B. H. Jennings, E. R. Queer*, J. A. Reyniers, Mildred W. Wells, M.D., C.-E. A. Winslow.

Combustion: R. K. Thulman, *Chairman*; P. R. Achenbach, J. F. Barkley, L. L. Connell, R. C. Cross*, R. B. Engdahl, R. C. Johnson, W. B. Kirk, J. W. Miller, W. M. Myler, Jr., H. J. Rose, K. O. Schlentner, E. T. Selig, Jr., T. H. Smoot.

Cooling Load: W. E. Zieber*, *Chairman*; C. M. Ashley, R. D. Blum, W. F. Friend, R. H. Heilman, H. W. Heisterkamp, R. C. Jordan, C. F. Kayan, J. N. Livermore, R. H. Lock, C. O. Mackey*, J. P. Stewart.

Corrosion: L. F. Collins, *Chairman*; A. S. Gates, Jr., A. E. Griffin, E. W. Guernsey, R. L. Hallett, P. G. Kayser, H. A. Pray, F. N. Speller, T. H. Urdahl*.

Heat Flow Through Glass: R. A. Miller, *Chairman*; A. B. Algren*, A. H. Baker, F. L. Bishop, Jr., J. E. Frazier, J. S. Herbert, E. H. Hobbie, L. K. Jones, C. O. Mackey*, F. W. Preston, W. C. Randall, Vic Sanders, H. B. Vincent, G. B. Watkins, F. C. Wood.

Heating Load: T. F. Rockwell, *Chairman*; C. M. Ashley, R. A. Biggs, A. I. Brown, R. C. Cross*, R. S. Dill, W. S. Harris, J. M. Hartman, S. I. Rottmayer, M. W. Shears, G. H. Tuttle.

Industrial Ventilation: W. N. Witheridge, *Chairman*; A. D. Brandt, W. B. Harris, W. C. L. Hemeon, D. E. Humphrey, C. W. Johnson*, J. M. Kane, M. G. Kershaw, L. L. Lewis, L. G. Miller*, H. A. Mosher, B. F. Postman, B. R. Small, R. P. Warren, H. E. Ziel.

Insulation: E. R. Queer*, *Chairman*; R. E. Backstrom, C. B. Bradley, R. B. Crepps, C. H. Jefferson, H. E. Lewis, L. E. Pasek, H. E. Robinson, Vic Sanders, T. D. Stafford, L. V. Teesdale, R. K. Thulman, T. T. Tucker, P. M. Woodworth.

Panel Heating and Cooling: G. D. Winans, *Chairman*; A. B. Algren*, R. L. Byers, P. B. Gordon, L. N. Hunter* (*Ex-Officio*), John James*, J. S. Locke, John Magos, H. F. Randolph, Cyril Tasker (*Ex-Officio*).

Group A—Heat Distribution Within and Behind the Panel: P. B. Gordon, *Chairman*; A. B. Algren*, R. A. Biggs, R. S. Dill, H. L. Flodin, F. E. Giesecke, W. S. Harris, C. F. Kayan, G. D. Lain, C. W. Meininger, D. L. Mills, C. W. Nessell, P. S. Park, S. I. Rottmayer, S. K. Smith, R. K. Thulman, S. M. Van Kirk, G. L. Wiggs, L. H. Yeager.

Group B—Heat Transfer Between the Panel and the Space: John James*, *Chairman*; H. F. Randolph, *Vice Chairman*; C. M. Ashley, J. T. Bergen, C. F. Boester, Wharton Clay, Linn Helander, A. L. Jaros, Jr., H. A. Lockhart, C. O. Mackey*, R. A. Miller, G. W. Penney, G. G. Sward, J. M. van Nieukerken.

Group D—Controls: J. S. Locke, *Chairman*; A. B. Algren*, H. W. Alyea, S. D. Browne, R. L. Campbell, C. M. Garner, P. B. Gordon, W. J. Hajek, A. J. Keating, W. H. Kliever, H. T. Kucera, P. F. Neess, R. S. Penn, J. K. M. Pryke, E. J. Ritchie, C. W. Signor, N. D. Skinner, A. S. Widdowfield.

Physiological Research: C.-E. A. Winslow, *Chairman*; Thomas Bedford, M.D., Capt. A. R. Behnke, MC, USN, E. W. Brown, M.D., A. C. Burton, M.D., E. F. DuBois, M.D., A. P. Gagge, R. M. Graham, M.D., R. W. Keeton, M.D., D. H. K. Lee, M.D., L. G. Miller*, André Missenard, Charles Sheard.

Sorbents: John Everetts, Jr., *Chairman*; F. C. Dehler, M. C. Giannini*, C. H. B. Hotchkiss, E. R. McLaughlin, J. C. Patterson, G. L. Simpson, F. J. Swaney.

Weather Design Conditions: T. H. Urdahl*, *Chairman*; J. C. Albright, P. D. Bemis, H. S. Birkett, J. P. Fitzsimons, J. H. Hart, W. L. Holladay, W. M. Wallace, II.

*Member of Committee on Research.

OFFICERS OF LOCAL CHAPTERS AND STUDENT BRANCHES

(41 Chapters—3 Student Branches)

Atlanta: Organized, 1937. Headquarters, Atlanta, Ga. Meets, First Friday. President, L. L. Barnes, 3865 Wieuca Terrace. Secretary, R. L. Beach, 131 Clarion Ave., Decatur.

•

Central New York: Organized 1944. Headquarters, Syracuse, N. Y. President, D. L. Mills, 1407 N. Madison St., Rome. Secretary, J. H. Carpenter, 3515 Midland Ave., Syracuse 7.

Central Ohio: Organized, 1944. Headquarters, Columbus, Ohio. Meets, Third Monday. President, W. M. Myler, Jr., P.O. Box 267, Columbus 16. Secretary, H. G. Hays, 851 W. Third Ave., Columbus 8.

Cincinnati: Organized 1932. Headquarters, Cincinnati, Ohio. Meets First Tuesday. President, M. E. Mathewson, 1211 Enquirer Bldg., Cincinnati 2. Secretary, E. W. McNamee, 1729 John St., Cincinnati 14.

Connecticut: Organized, 1940. Headquarters, New Haven, Conn. President, E. C. Marsden, 44 Hicks St., Hartford. Secretary, T. L. Arnold, 26 Francis Ave., Hartford.

•

Delta: Organized, 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. President, L. V. Busenlener, 2927 Jackson Ave., New Orleans 13. Secretary, Ralph Elizardi, 314½ St. Charles Ave., New Orleans 12.

•

Golden Gate: Organized, 1937. Headquarters, San Francisco, Calif. Meets, First Thursday. President H. V. Hickman, 1129 Folsom St., San Francisco 1. Secretary, R. C. Cushing, 1136 Howard St., San Francisco 3.

•

Illinois: Organized, 1906. Headquarters, Chicago, Ill. Meets, Second Monday. President, C. M. Burnam, Jr., 6 N. Michigan Ave., Chicago 2. Secretary, G. W. Bornquist, 629 W. Washington Blvd., Chicago 6.

Indiana: Organized, 1943. Headquarters, Indianapolis, Ind. Meets, Fourth Friday. President, P. R. Jordan, 311 E. South St., Indianapolis 4. Secretary, C. F. A. Locke, 111 E. 34th St., Indianapolis 5.

Iowa: Organized, 1940. Headquarters, Des Moines, Ia. Meets, Second Tuesday. President, D. C. Murphy, 840 Fifth Ave., Des Moines 14. Secretary, R. S. Stover, Kresge Bldg., Marshalltown.

•

Kansas City: Organized, 1917. Headquarters, Kansas City, Mo. Meets First Monday. President, H. E. Gould, 1924 Oak Rd., Kansas City 8. Secretary, K. M. Stevens, 1510 Main St., Kansas City.

•

Manitoba: Organized, 1935. Headquarters, Winnipeg, Man., Canada. Meets, Third Thursday. President, J. R. Stephenson, 838 Notre Dame Ave., Winnipeg. Secretary, D. F. Michie, 838 Notre Dame Ave., Winnipeg.

Massachusetts: Organized, 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. President, R. T. Kern, 51 Claflin St., Leominster. Secretary, D. W. Blair, 59 Frost St., Cambridge.

Memphis: Organized, 1944. Headquarters, Memphis, Tenn. Meets, First Monday. President, E. E. Scott, 918 Dermon Bldg., Memphis 3. Secretary, A. T. Bevil, 1521 Waverly Ave., Memphis 6.

Michigan: Organized, 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. President, E. F. Hyde, 708 Oakland Ave., Birmingham. Secretary, J. H. Spurgeon, 5050 Joy Rd., Detroit 4.

Minnesota: Organized, 1918. Headquarters, Minneapolis, Minn. Meets, First Monday. President, O. L. Lilja, 5000 16th Ave., S., Minneapolis 7. Secretary, E. F. Snyder, Jr., 4324 Zenith Ave., N., Minneapolis 12.

Montreal: Organized, 1936. Headquarters, Montreal, Que., Canada. Meets, Third Monday. President, Leo Garneau, 25 Salisbury Rd., Pointe Claire, Que. Secretary, R. R. Noyes, 630 Dorchester St. W., Montreal.

•

Nebraska: Organized, 1940. Headquarters, Omaha, Neb. Meets, Second Tuesday. President, K. R. Magarrell, 127 So. Main St., Council Bluffs, Ia. Secretary, F. E. Prawl, 2820 Harney St., Omaha 2.

New York: Organized, 1911. Headquarters, New York, N. Y. Meets, Third Monday. President, A. A. Bearman, 444 West 56th St., New York 19. Secretary, Carl H. Flink, Room 3000, 51 Madison Ave., New York 10.

North Carolina: Organized, 1939. Headquarters, Durham, N. C. Meets, Quarterly. President, E. S. deWitt, 1211 Commercial Bank Bldg., Charlotte. Secretary, R. M. Warren, Jr., 1001 N. Church St., Charlotte 1.

North Texas: Organized, 1938. Headquarters, Dallas, Tex. Meets, Third Monday. President, B. S. Foss, Jr., 711 Construction Bldg., Dallas 1. Secretary, Herman Blum, Jr., 2812 Fairmount St., Dallas 4.

Northeastern Oklahoma: Organized, 1948. Headquarters, Tulsa, Okla. President, W. R. Lee, 303 Beacon Bldg., Tulsa 3. Secretary, R. F. Shoemaker, 1136 So. Peoria, Tulsa.

Northern Ohio: Organized, 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. President, W. R. Moore, 5005 Euclid Ave., Cleveland. Secretary, John Richmond, 10210 Woodland Ave., Cleveland 4.

Oklahoma: Organized, 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. President, J. H. Spaan, Jr., 1303 N. Klein, Oklahoma City 6. Secretary, J. R. Patten, 627 N.W. Second St., Oklahoma City.

Ontario: Organized, 1922. Headquarters, Toronto, Ont., Canada. Meets, First Monday. President, E. G. Spall, 73 Simcoe St., Toronto 1. Secretary, H. R. Roth, 57 Bloor St., W., Toronto, Ont.

Oregon: Organized, 1939. Headquarters, Portland, Ore. Meets, Thursday after First Tuesday. President, E. R. Lokey, 1238 N. W. Glisan St., Portland 9. Secretary, A. N. Hoss, 621 S. W. Alder, Portland.

•

Pacific Northwest: Organized, 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday. President, L. L. Bysom, 1214 Eighth St., Bremerton. Secretary, D. O. Mead, 816 Arctic Bldg., Seattle 4.

Philadelphia: Organized, 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. President, J. O. Kirkbride, Fourth & Locust Sts., Philadelphia 6. Secretary, M. E. Barnard, 12 S. 12th St., Philadelphia 7.

Pittsburgh: Organized, 1919. Headquarters, Pittsburgh, Pa. Meets, Second Monday. President, H. E. Park, 201 E. Carson St., Pittsburgh 19. Secretary, E. H. Riesmeyer, Jr., 231-33 Water St., Pittsburgh 22.

•

Rocky Mountain: Organized, 1944. Headquarters, Denver, Colo. Meets, First Wednesday. President, Fred Janssen, 1123 W. Third Ave., Denver 9. Secretary, F. C. Allen, 4467 King St., Denver 11.

•

St. Louis: Organized, 1918. Headquarters, St. Louis, Mo. Meets, First Tuesday. President, B. L. Evans, 571 Stratford Ave., University City. Secretary, C. H. Burnap, 1635 Syndicate Trust Bldg., St. Louis 1.

Shreveport: Organized 1948. Headquarters, Shreveport, La. President, W. E. FitzGerald, 939 Louisiana Ave., Shreveport. Secretary O. J. Dykes, Jr., 1012 Market St., Shreveport.

South Texas: Organized, 1938. Headquarters, Houston, Tex. Meets, Third Friday. President, C. C. Quin, 809 Stuart Ave., Houston 6. Secretary, R. J. Salinger, 4510 Dewberry Lane, Houston 4.

Southern California: Organized, 1930. Headquarters, Los Angeles, Calif. Meets, Third Wednesday. President, R. S. Farr, 2615 Southwest Dr., Los Angeles. Secretary, L. J. Helms, 633 S. Berendo St., Los Angeles 5.

Southwest Texas: Organized, 1946. Headquarters, San Antonio, Tex. President, G. R. Rhine, 1208 Alamo National Bldg., San Antonio. Secretary, I. W. Wilke, 422 Congress Ave., Austin.

•

Utah: Organized, 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. President, E. J. Watts, 2485 Douglas St., Salt Lake City 5. Secretary, R. H. East, 326 E. First So., Salt Lake City.

•

Virginia: Organized, 1946. Headquarters, Norfolk, Va. Acting President, J. E. White, 7607 Gloucester Ave., Norfolk 5. Secretary D. E. Phillips, P. O. Box 674, Newport News.

•

Washington, D. C.: Organized, 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. President, A. S. Gates, Jr., 621 N. Jackson St., Arlington, Va. Secretary, J. G. Muirheid, 2013 New Hampshire Ave., N. W., Washington 9.

Western Michigan: Organized, 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. President, H. W. Wolters, 820 Staples Ave., N.W., Kalamazoo 54. Secretary, H. R. Limbacher, 760 E. Vine St., Kalamazoo.

Western New York: Organized, 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. President, Edwin Woolcock, 2217 15th St., Niagara Falls, N. Y. Secretary, T. F. Killeen, 374 Delaware Ave., Buffalo 2.

Wisconsin: Organized, 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. President, W. A. Ouweneel, 514 E. Ogden Ave., Milwaukee 2. Secretary, H. F. Brinen, 2226 Kinzie Ave., Racine.

Student Branches

North Carolina State College: Organized 1948. Headquarters, Raleigh, N. C. President, J. G. Marshall, North Carolina State College. Secretary, Basil Greene, Apt. D-2, Grosvenor Garden Apts., Raleigh.

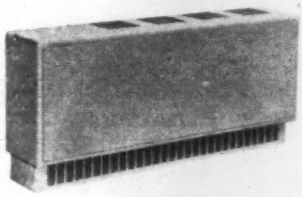
Purdue University: Organized 1948, Headquarters, W. Lafayette, Ind. Chairman, R. G. James, 411 E. 37th St., Indianapolis. Secretary D. M. Long, FPHA Apt. 423-2, W. Lafayette.

Texas A. & M. College: Organized, 1946. Headquarters, College Station, Tex. Meets, Third Thursday. President, S. E. Ammons, 212 13th Ave., No., Texas City. Secretary, C. P. Howard, Box 1706, College Station.

EQUIPMENT DEVELOPMENTS

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1948 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

Offers Cabinet Type Unit Heater for Low Noise Level Applications

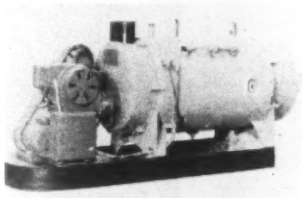


No. 3889—Deliveries are now being made on the new Webster-Nesbitt series R, cabinet type unit heater. Of modern cabinet design, this de luxe heater is the successor to the series F unit heater. It is manufactured by John J. Nesbitt, Inc. and is distributed by Warren Webster & Co., Camden, N. J.

Units are available in four sizes with one, two, three, four, or five belt driven fans of the centrifugal, forward curved blade type. They are said to be especially suitable for low noise level applications, such as in offices, churches, lobbies, restaurants, etc. Adjusted for higher fan speed, they are said to be suitable for any commercial or industrial application.

The heating element, of the hairpin circuit type with supply and return headers at one end, consists of copper tubing and aluminum fins. Where desired, air filters may be used below the heating element. The cabinet is of furniture steel and is finished in lizard brown "featherweave" or neutral gray prime. Air deliveries with standard drive range from 518 to 1890 cfm and capacities are from 158 to 588 E.D.R. at 2 psi steam. The heaters may also be used with hot water systems.

Develops Hot Water Generator for Commercial, Industrial Use



No. 3890**—A new, completely automatic hot water generator has been developed by Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee 12, for high capacity hot water heating in large commercial and industrial buildings.

Available in either oil or gas fired models, the new generator is offered in two sizes, 550,000 and 730,000 Btu per hr output. These ratings correspond to 665 and 875 gph at 100 deg rise.

Exclusive four pass construction of the generator shell is said to insure high efficiency (over 80 percent). Industrial type safety controls are used and a hinged rear door, lined with refractory, provides accessibility for cleaning and maintenance. The generator shell and the tubes are galvanized and the former is covered with an insulation jacket.

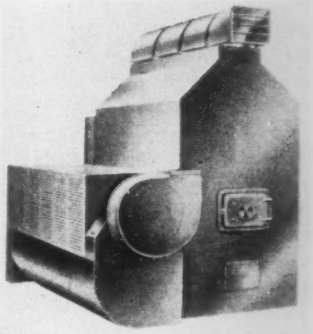
The large unit, measuring 113 x 44 x 26½ in., may be passed through a standard door opening, though the front end of the base, including the burner, may be removed for separate handling where required. All units are constructed in accordance with the ASME code.

Control System Regulates Humidity in Barns

No. 3891—A new humidity control system for protecting barns, livestock, and farm equipment has been announced by Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Wayne and Roberts Aves., Philadelphia 44.

The new control system, which is designed to do away with excessive animal produced moisture, is being distributed through wholesalers of farm and electrical equipment and is used to control fans and other devices, "automatically maintaining temperature and humidity at desired levels, according to the area in which installations are made." The system will also do away with spontaneous combustion dangers and fodder mildewing and spoilage, according to the company.

Individual Type Warm Air Heater Is Coal Fired



No. 3892—Development of a coal fired warm air space heater for factories, foundries, warehouses, garages, and other industrial and commercial establishments has been announced by Dravo Corp., Dravo Bldg., Pittsburgh. The new model supplements the company's "Counterflo" oil or gas fired heaters and can be converted for firing with either of those two kinds of fuel.

One of the chief features of the unit, besides its fuel convertibility, is said to be the use of a stainless steel combustion chamber. Use of this metal is designed to increase service life and to eliminate a substantial amount of the customary side wall refractory.

FOR YOUR CONVENIENCE

Heating, Piping & Air Conditioning [11-48]
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each number in which you are interested)

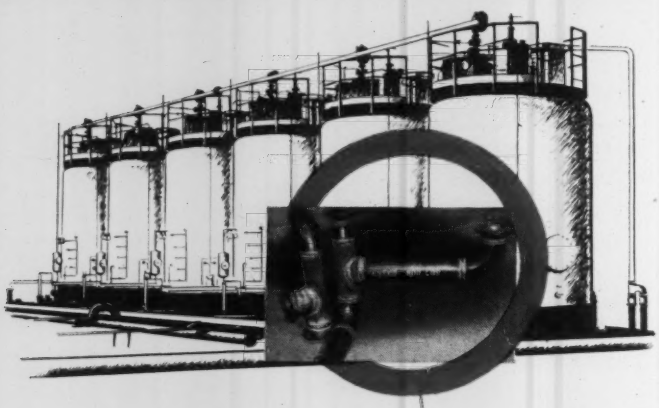
3889 3890 3891 3892 3893 3894 3895 3896 3897 3898
3899 3900 3901 3902 3903 3904 3905 3906 3907 3908
3909 3910 3911 3912 3913 3914 3915 3916 3917 3918
3919 3920
7025 7026 7028 7029 7030 7031 7032 7033 7034
7035 7036 7037 7038 7039 7040 7041 7042 7043 7044
7045 7046 7047 7048 7049 7050 7051 7052 7053 7054
7055

Name ..... **Title** .....

Company .....

Address .....

City ..... **Zone** ..... **State** .....



SALT IS GOOD ON TOMATOES — BUT NOT IN CRUDE OIL

"Salts in crude oil are an annoying headache to refiners. They cause frequent shut-downs because of salt plugging, corrosion from evolved HCl, and the deposition of hard coke. The Petreco Electric Desalting Process, developed by the Petroleum Rectifying Company, effectively eliminates the salt, with a corresponding reduction in the refining problems it causes. The Petreco Process is widely used by refiners throughout the United States, Canada, and South America.

"The Petroleum Rectifying Company has found that Bonney WeldOlets* and ThredOlets* insure strong, leak-proof pipe connections and are very effective wherever 90 degree branch connections are needed, regardless of the pipe size. Not only do WeldOlets* give the "balanced flow" which is vitally important in their multiple unit operation, but they also speed up layout, save welding time."

ThredOlets* make a stronger connection than couplings, and the use of both WeldOlets* and ThredOlets* gives them savings of 25% and more.

WeldOlet Fittings can be welded to pipes wherever outlets are required, eliminating costly pipe threading, reducing new construction and maintenance costs. They are safe, efficient, quickly installed.

Write today for our handbook. It may suggest ways in which WeldOlet Fittings can cut *your* labor costs. There is a distributor in every principal city.

YOU GET 7 IMPORTANT ADVANTAGES WITH WELDOLETS*. .

1. Full pipe strength
2. Ease of installation (no forming, fitting, aligning, beveling)
3. Ease of inspection (circles, weld metal and flash easily seen—easily removed)
4. Improved flow conditions
5. Uniform appearance
6. Reduced weight and space
7. Highest quality installation at minimum cost

BONNEY FORGE & TOOL WORKS
Forged Fittings Division,
350 Green Street
ALLENTOWN, PENNA.
MANUFACTURERS OF FAMOUS BONNEY TOOLS

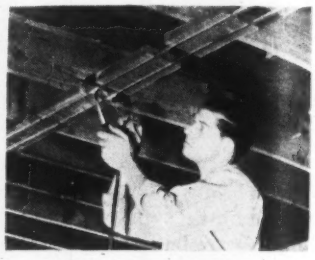
WELDOLETS
*TRADE MARK REG. U.S. PAT. OFF. PAT. IN U.S. & FOREIGN COUNTRIES

FOR WELDED BRANCH PIPE OUTLETS
When you want Bonney Welding Outlets, ask for WeldOlets*

Air is drawn into the base, passed over economizer tubes and the combustion chamber, and discharged through overhead nozzles. In this way, says the manufacturer, heat is "held in the working zone." The heater can be used with or without ducts, and can be adapted to bring in and heat outside air for applications that require an arrangement for tempering make-up air. It is also usable for summer ventilating and is adaptable for process drying and curing. Standard equipment with the heater includes a hopper model bituminous coal stoker. Anthracite or bin fed stokers also can be supplied. Blowers and an induced draft fan are mounted on a single shaft driven by a single motor, and fans, bearings, and motor are located at the floor level.

The new model is available in two output capacities: 1,250,000 and 1,500,000 Btu per hr.

Uses Finned Coils for Radiant Panel Heating



No. 3893**—Finned heating coils for installation in radiant panel systems have been announced by Kritzer Radiant Coils, Inc., 2901 W. Lawrence Ave., Chicago.

Offered in standard lengths of approximately 10 ft with finned sections to fit 12, 16, and 24 in. joist or stud spacing, the coils are constructed of two parallel runs of $\frac{5}{8}$ in. copper tubing on 3 in. centers. The aluminum fins are $1\frac{1}{2}$ x 6 in. and are mechanically bonded to the tubing.

According to the company, the coils may be used with wall, floor, or ceiling panels and are designed to heat the air in the enclosed spaces behind the panels. Advantages are said to include low first cost, low installation cost, the fact that water up to 240 F may be used without damaging plaster, and "reduction in time lag (from the control standpoint) by the use of small volumes of water."

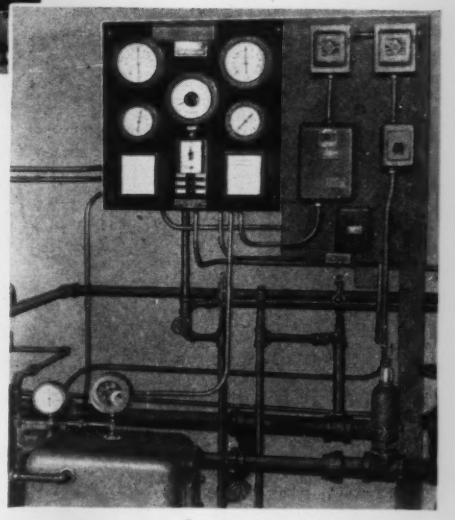
Air Diffuser Cone Reduces Ceiling Smudge

No. 3894—An anti-smudge cone for its "Kno-Draft" adjustable air diffuser has been announced by W. B. Connor Engineering Corp., 114 E. 32nd St., New York 16. Fitting snugly between the outer rim of the diffuser and the ceiling, the cone is designed to provide separation of the air stream from the ceiling, and at the same time, to complement the appearance of the diffuser.

In addition to inhibiting ceiling smudge, encountered where sooty, smoky, or dusty air is circulated or where there are rough-textured ceilings, the cone is said to reduce the space requirements between the face of the duct and the finished ceiling. In addition, the manufacturer states that greater latitude is provided between the ceiling opening and the outside rim of the diffuser so that less care need be taken in cutting ceiling openings.

Cones are furnished for both supply and combination supply and return diffusers from 4 to 18 in. neck diameter.

St. Raphael School, Chicago
George S. Smith, Chicago, Architect
McDonald & Trunck Co., Chicago
Heating Contractors



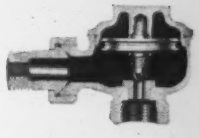
ILLINOIS

Automatic

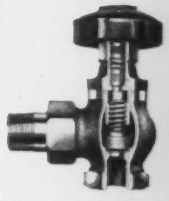
Steam and Fluid Control Equipment

Type C Generation Control System

Maximum fuel economy, comfort and convenience are assured by this type of system BECAUSE it is a COMPLETE ILLINOIS SYSTEM. Fuel burning, steam circulation and temperature all are controlled automatically.



Steam is generated by two low-pressure boilers, oil-fired. The entire system of piping and radiation is Illinois equipped—radiator traps, valves, and Float and Thermostatic traps. Control is applied to the fuel burning. Thus, efficient and rapid steam circulation is assured over a pressure range from one pound to 20 inches vacuum, and stack temperature and boiler losses are reduced to a minimum.



•

Other ILLINOIS Heating Systems include Type A Continuous Flow Control and Type E Cycling Flow Control, as well as the Standard Vacuum and Vapor Systems.

Write for bulletins

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

"FREEZING" is expensive

WHERE BASIC DESIGNS IN ELECTRIC CONTROLS ARE RESULT-ENGINEERED FOR YOU

Unique design and spring suspension prevent it in this Ward Leonard Relay

The generous wipe imparted to the contacts of Ward Leonard Heavy Duty (105) Relay by its unique design and spring suspension, results in freedom from contact "freezing" or welding.

This mighty midget will perform motor starting functions ordinarily assigned to larger relays.

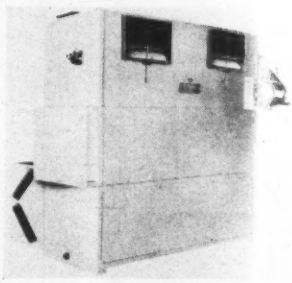
Ward Leonard relays are "Result-Engineered". By modifying a basic design, Ward Leonard can give you the results of a special . . . for the price of a standard.

Write for Relay Catalog. Ward Leonard Electric Co., 24 South St., Mount Vernon, N. Y. Offices in principal cities of U.S. and Canada.

WARD LEONARD ELECTRIC COMPANY

RESISTORS · RHEOSTATS · RELAYS · CONTROL DEVICES

Line of Central System Conditioners Developed for Many Applications



No. 3895—Central system air conditioners designed and built for matched operation with its compressors and refrigerant control valves have been added to the air conditioning lines of Frigidaire Div., General Motors Corp., Dayton 1, Ohio.

Eight new units, including both vertical floor type and suspended horizontal models, with nominal capacities ranging from 5 to 40 tons have been designed for business houses, institutions, and industrial applications. New models, equipped with either "Freon" or water type "Multipath" cooling units, are available for use in hotels, restaurants, small theaters, stores, hospitals, and other similar establishments.

Year around air conditioning is afforded by adding accessories such as heating coils, equipped with dual steam distributor tubes, and a humidifier assembly. Face and bypass dampers can also be added.

The company is also manufacturing a complete line of condensing units, especially designed for use with this new central system air conditioning equipment. These units range from 7½ to 25 hp.

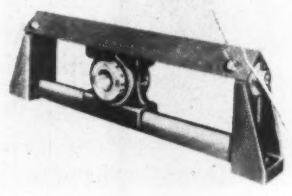
Bronze Valves Have Interchangeable Discs and Seat Combinations

No. 3896—Highlight of the new 300 lb bronze globe and angle valves now offered by Fairbanks Co., 393 Lafayette St., New York 3, is said to be the interchangeability of the disc and seat combinations for full portway (two types) and throttle portway use.

The three types include either heat treated stainless steel plug discs and seats of approximately 500 Brinell hardness or nickel alloy radial discs and seats; while all three are constructed with back-seated rings having a pressure-tight joint between seat ring threads and line pressure. Canting and cocking of the disc, says the company, are prevented by the improved below-the-shoulder position of the stem in the newly developed guided-disc construction.

Angle valves are available with the same combinations as globe valves. Sizes are from ¼ to 2 in.

Roller Bearing Has Adjustable Take-Up



No. 3897—The type E "Take-Up", offered by Dodge Mfg. Corp., Mishawaka, Ind., is essentially a roller bearing pillow block equipped with a take-up adjustment.

The unit, which has a welded steel frame, is said to be suitable for severe service conditions. Adjustment is effected by turning screw heads at either end. The angle top member is designed to provide protection against dust and dirt.

Also available is a similar type H unit having a babbitted sleeve bearing.

Welding the Piping for an Extraction Plant

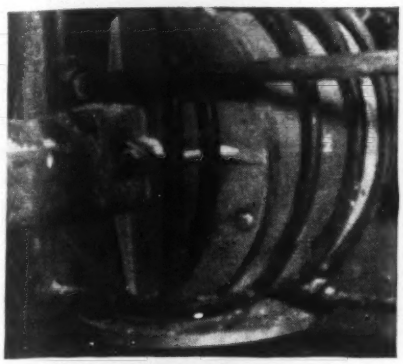


Fig. 1. Steam jacket made of small pipe.

By H. E. Wetzell, President
Smith & Oby Co., Piping Contractors
Cleveland, Ohio

PROBLEMS which could be solved only with arc welding were encountered in practically every foot of the special process piping which we fabricated and installed in the Sherwin-Williams Company's new extraction plant in Cleveland. This is the pilot plant for a new process of making linseed and castor oils.

Fig. 1 shows a large valve surrounded by a jacket of small diameter steam piping. Located on the bottom of a castor bean cooker, this clean-out valve has a steam jacket to increase fluidity of the pulpy material. The jacket was welded in two sections which were screwed together with collars. Pipe is mild steel, ½″ inside diameter. Joints were beveled 30° and welded with ⅛″ diameter "Fleetweld 5" electrode in three passes. A sheet metal casing will be added to retain the heat.

Another interesting part of the job was vapor lines which were completely encased with steam jackets. Fig. 2 shows a partially-assembled "T" section of the vapor line, with both 6″-diameter main pipe and the 8″ steam jackets visible. Spiral steel pipe, 16 gauge, was used for both. The pipe was centered in the jacket for welding by inserting 1″ steel spacers which were shaken out after welding. Two passes of ⅛″ "Fleetweld 5" were used to make all welds.

Fig. 3 is a view of part of the vapor line system. The frequent shut-off valves in the main pipe separated the jackets into sections, each of which had to be fed individually by steam lines. Note the clean-out ports near each elbow and connection in the jackets.

Fig. 4. Welding flange to 3″ Pipe.

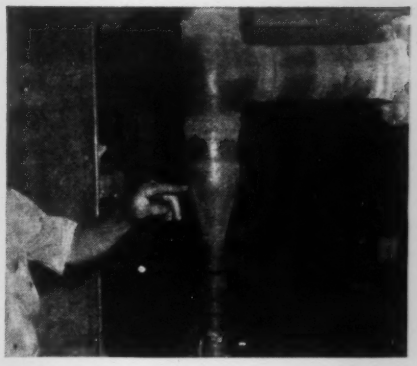


Fig. 5. Welded taper, from 4″ to 1½″ diameter.

A great number of bolted flange connections were used so any part of the plant could be easily dismantled. The flanges were arc welded to the pipe to avoid interior unevenness which might slow down the flow of some of the materials. Fig. 4 shows how flanges were welded to pipe, using an angle for easy turning. The flange and pipe are first set upright and tackwelded together. This 3″ diameter was welded with two passes of 5/32″ "Fleetweld 5."

A fabricated reduction from 4″ to 1½″ diameter pipe is shown in Fig. 5. It was made by coping out triangular sections with a torch, hammering and tackwelding the sides together, and welding with three passes of ⅛″ "Fleetweld 5".

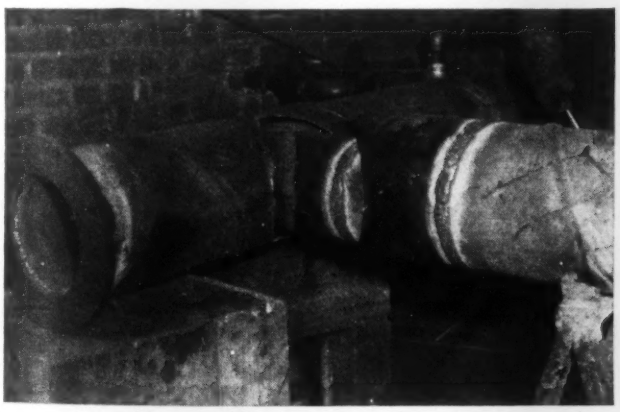


Fig. 2. "T" section of vapor line, with inside pipe and steam jacket both visible.

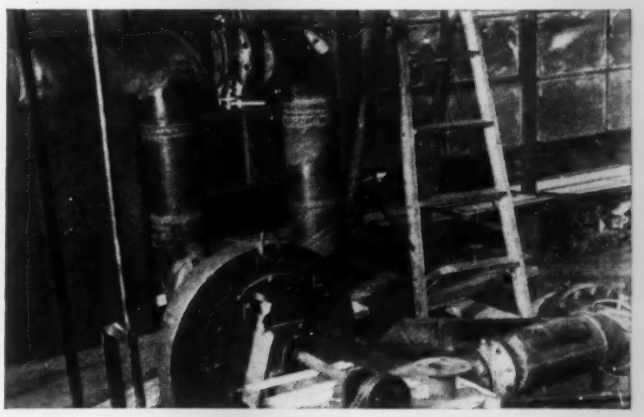
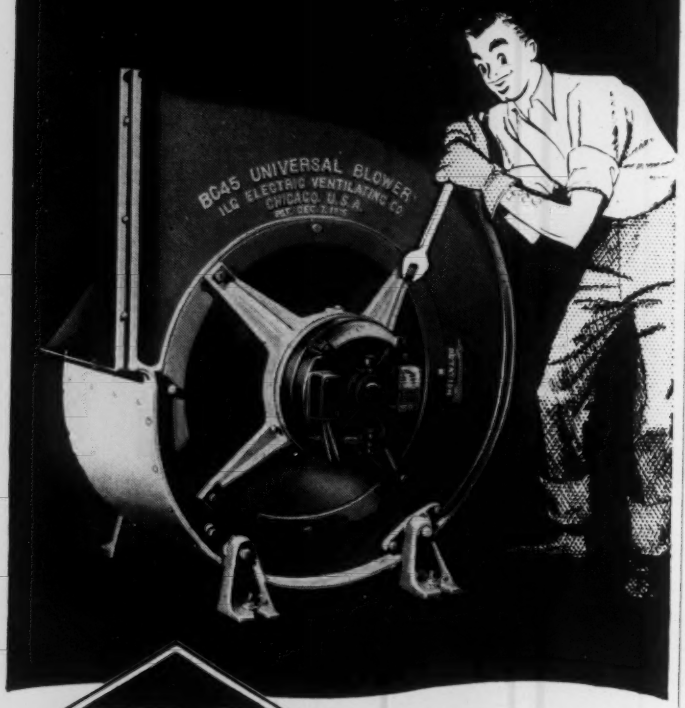


Fig. 3. Part of vapor line installation. 16 gauge spiral pipe was used.

The above is published by LINCOLN ELECTRIC in the interests of progress. Properties and procedures of "Fleetweld 5" electrode are given in Bul. 403. Write The Lincoln Electric Company, Dept. 273, Cleveland 1, Ohio.

THE AIR YOU BREATHE SHOULD BE AS PURE AS THE WATER YOU DRINK

CUT YOUR COSTS WITH DIRECT DRIVE



ILG VENTILATION

Save dollars on every job with ILG Direct-Drive Centrifugal Fans. No time-wasting alignment, no belts or pulleys to increase labor and material costs. No special motor bases to boost your costs, no belt or chain guards to buy and install, no extras to reduce your profits!

You handle more jobs with the same man power, while giving your customer the best possible equipment. You save space, you have permanent alignment (no rapidly wearing parts). You avoid frequent shutdowns for replacement or servicing of parts. You eliminate power-wasting friction and noise. Your ILG equipment delivers full rated capacity.

Get latest data on ILG profit-makers phone nearby Branch Office (consult classified directory) or send coupon.

ILG ELECTRIC VENTILATING CO., 2841 N. Crawford Ave. Chicago 41, Ill. Offices in more than 40 Principal Cities.

☐ Send free copy new Catalog No. 247.

Firm Name.....

Individual..... Title.....

Address..... Zone.....

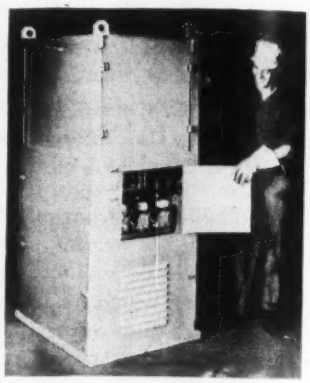
City..... State.....

Circulates Hot Water in Heating Systems

No. 3898*—The new hot water circulating pump developed by Fairbanks, Morse & Co., Fairbanks - Morse Bldg., Chicago 5, Ill., features a single suction, open type impeller of all bronze construction. Other features are said to include the use of a resilient mounting and molded rubber shaft couplings, a cast iron pump body and fittings, a "precision machined" steel shaft, and powdered bronze bearings.

Pumps are available in six sizes and capacities ranging from 1 in. (25 gpm) to 3 in. (145 gpm) and can be installed in either horizontal or vertical lines.

Small Unit Heats and Cools Crane Cabs



No. 3899—A small 3 hp air conditioning unit for installation in crane cabs has been developed by Dravo Corp., Dravo Bldg., Pittsburgh. The new model is about half the size of the company's C-5 cooler used to condition the cabs of cranes operating in extremely high temperatures such as those found near steel mill soaking pits.

Designed for operation in ambient temperatures up to 130 F, the new equipment is said to maintain cab temperatures at 80 to 85 F in the summer, and 68 to 72 F in the winter. A vertical unit, it can be mounted alongside a crane cab or placed on adjoining catwalks. Air is used for condensing purposes in the cooling coils and the refrigerant is "Freon 114." To provide continuous ventilation in the crane cab, approximately 300 cfm of return air, blended with about 100 cfm of makeup air, is introduced into the cooler. Filters are used to remove dirt and dust from both return and makeup air. Activated carbon canisters in the air stream are said to remove fumes, gases, and irritants. Electric strip heaters of chrome steel sheathed with monel metal fins provide for winter heating.

According to the company, the unit is suitable for use in factories or foundries where aluminum, copper, lead, manganese, magnesium, paint, and cement are handled or produced.

Unloader Controls Capacity of Refrigeration Compressors

No. 3900—Brunner Mfg. Co., 1821 E. Broad St., Utica 1, N. Y., has developed a capacity step control system for unloading cylinders of refrigeration compressors.

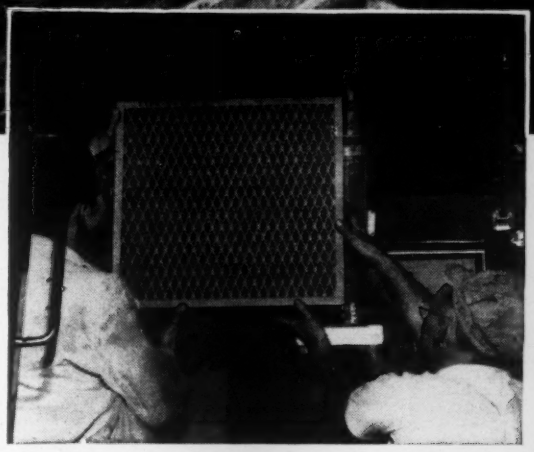
A pressure switch, which responds to fluctuations in suction pressure, is used to control a solenoid valve which in turn controls the flow of refrigerant discharge gas to the top of an unloader piston. During unloading, the piston is used to hold the cylinder suction valve open.

This step control of refrigeration capacity is designed to overcome short cycling and may be used to make one

New York Central's new 20th Century Limited is equipped with Air-Maze Filters

NEW YORK CENTRAL provides extra comfort for passengers in their new 20th Century Limited by using Air-Maze air filters to rid the air of dust, lint and dirt.

This progressive railroad is but one of many that specifies Air-Maze air filters as standard equipment. Leading hotels, office buildings and factories as well use Air-Maze filters in their ventilating systems. If you'd like the best answer to *your* filtration problems, follow their lead and call in Air-Maze—the filter engineers. Write Air-Maze Corporation, Cleveland 5, Ohio.



Installing Air-Maze filter on new 20th Century Limited passenger car under construction at the Pullman Standard factory.

EACH TYPE OF AIR-MAZE FILTER IS DESIGNED FOR A SPECIFIC PURPOSE

Air-Maze engineers have designed—not one—but *many* types of all-metal, cleanable impingement filters for various ventilating applications. Each type has a proved record of field performance to justify its place in the ventilating industry.

There is no *one* filter that meets *all* the requirements of the ventilating engineer. But the chances are there is a particular Air-Maze filter *engineered* to handle your specific ventilating job.

AIR-MAZE

THE FILTER ENGINEERS

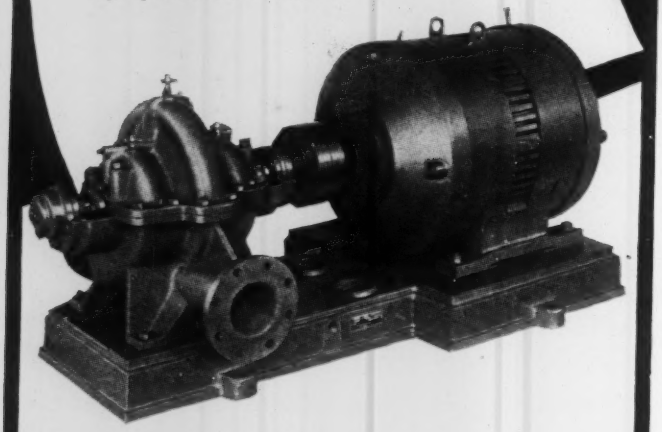
AIR FILTERS • SILENCERS • SPARK ARRESTERS • LIQUID FILTERS
OIL SEPARATORS • GREASE FILTERS

Recognition

Recognition of the excellence of a product is not gained overnight . . . it is *earned* by the continual production of good quality, precision built equipment.

Weinman pumps have been used in the air conditioning industry for many years to the complete satisfaction of engineers and service men. The air conditioning industry knows from experience that Weinman pumps do a job efficiently, dependably and economically.

The Weinman Pump Manufacturing Company has gained this recognition through years of maintaining an unvarying standard of quality and performance. Centrifugal pumps are Weinman's only product, which permits the knowledge and skill of their engineers and mechanics to be devoted solely to pumps. This means that requests for service, for advice, for parts, for new pumps, always are answered quickly by qualified men.



Type L-1 Split Case Pump, direct-connected to motor. For circulation of cooling water over condensers and atmospheric condensers. Worn parts can be replaced without disturbing or disassembling any pipe connections.

More details on Type L Split Case Pumps are contained in Bulletin 627-1. Sent on request.

Built by Centrifugal Specialists

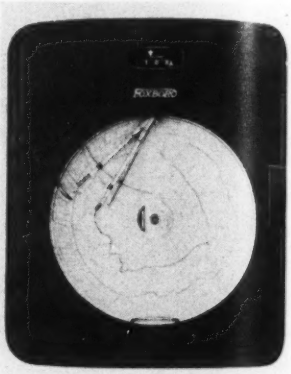
The WEINMAN Pump Mfg. Co.

COLUMBUS · 8 · OHIO

or more of the compressor cylinders inoperative. A four cylinder compressor, for example, can be unloaded 75 percent, leaving one cylinder in operation. This is done so that some cool suction gas will return to the compressor to maintain its temperature within reasonable limits.

According to the company, the control system is especially suitable for use in air conditioning systems, water chilling systems where uniform temperatures are required, in industrial liquid cooling systems where peak loads may be considerably higher than normal loads, etc.

Selective Control Instrument Handles Either of Two Variables

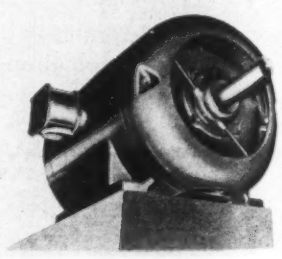


No. 3901 — According to Foxboro Co., Foxboro, Mass., the "Auto-Selector" controller is designed to control, selectively, from either of two related variables, by positioning a single valve, damper, or other operator. The selection is determined by the variable having the greater tendency to exceed its preset limit. The transfer of control is made automatically.

The device is said to do the work which previously required two controllers and, in addition, it may incorporate the automatic reset function in the control of either or both variables. The design embodies two measuring systems and two interconnected control mechanisms. Control action of both mechanisms may be on-off, proportional, proportional with derivative, proportional with reset, proportional with reset and derivative, or any combination of these.

A typical application, says the company, is in a pipeline pumping station where the device may be used to control either the discharge or suction pressure of a pump, in accordance with supply and demand requirements. Other examples are said to include the control of brine flow through a heat exchanger (to maintain the temperature of the cooled material at a preset value) and the control of fuel supply to operate an oven at a desired temperature, while keeping the heater temperature below a safe limit.

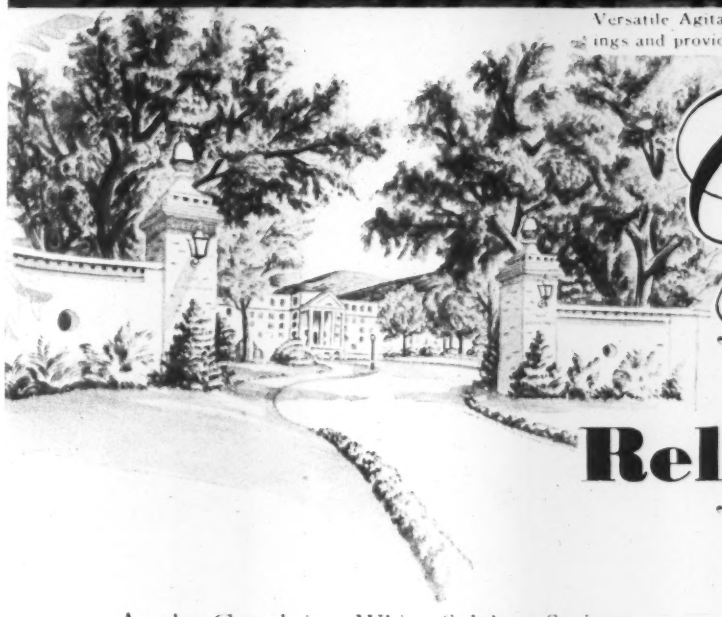
Explosion Proof Design Used in Large Motors



No. 3902—Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, is now building totally enclosed fan cooled motors in the 736 frame size, in ratings of 200 hp, for speeds of 3500, 1750, 1160, or 870 rpm, and for 550 volts or less. Also available are similar, 150 hp, 2300 volt motors operating at the same speeds.

These motors, says the manufacturer, are approved by the Underwriter's Laboratories for Class I, Group D and Class II, Groups E, F, and G hazardous locations. Features are said to include a cast aluminum rotor with heavy duty ball bearings, a one piece cast iron frame and an externally mounted fan.

Versatile Agitair Type R's placed around columns blend perfectly with surroundings and provide 100% air distribution in the Old White Club of The Greenbrier.



THE *Greenbrier*

"America's Most Beautiful Resort"

Relies on AGITAIR

"America's Most Versatile Diffuser"

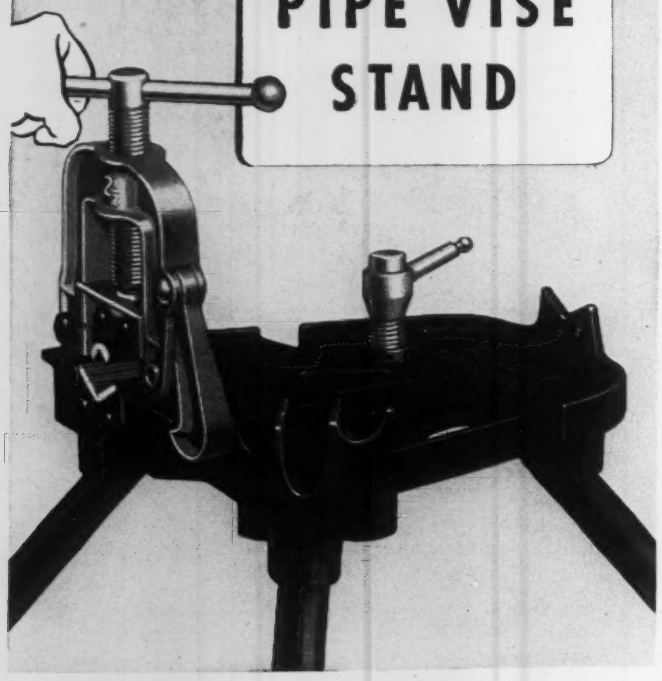
At the Greenbrier, White Sulphur Springs, W. Va., famous for luxurious comfort, you'll find Agitair Type R's providing correct air distribution. And no wonder, for here is a diffuser that offers the rare combination of efficiency plus beauty.

Yes . . . you'll find these superior diffusers everywhere — in smart hotels the world over, in restaurants, theaters, offices, homes . . . yes everywhere. *Write for complete data.*

AIR DEVICES, Inc.
17 East 42nd Street, New York 17, N. Y.
Ceiling Air Diffusers Air Filters Roof Exhausters

EASIER WORK

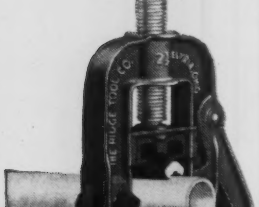
with this handy
PIPE VISE
STAND



RIDGID Tristand
is also a portable work bench

● Thousands of pipe experts use the tip-proof RIDGID Tristand both as a pipe vise *and* an on-the-job work bench. Hinged legs fold in and chain for easy carrying. Roomy tray for oil can, dope pot; special slots for hanging tools. Pipe rest and three handy benders that won't dent pipe. LonGrip tool steel vise jaws hold pipe firmly, won't mar polished pipe. The Tristand is made also with chain vise, capacity 4." Buy these handy efficient vises at your Supply House.

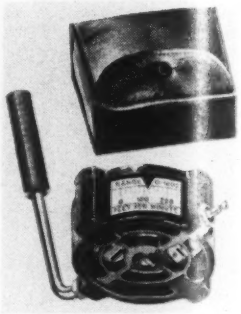
●



◀ RIDGID *Pipe Vises include bench, post, stand and kit models—yoke and chain.*

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

Direct Reading Meter Indicates Air Velocity

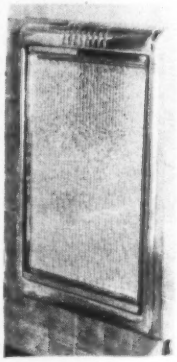


No. 3903*—Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh 8, Pa., has introduced the "Airite" grille velocity meter, for indicating the velocity of air movement in an open space, as for example, air velocity at the face of supply or return air registers.

Velocities between 0 and 1200 fpm are indicated directly in feet per minute on a calibrated scale by positioning the meter squarely against the air flow. The unit is self contained and measures $3\frac{3}{8}$ x $3\frac{3}{8}$ x $1\frac{5}{8}$ in. It is equipped with a detachable handle for use on baseboard or low sidewall registers. A piece of $\frac{1}{8}$ in. pipe may be screwed into the handle for use on high side wall registers and ceiling outlets.

Unusual features are said to include an 8 in. long scale with 20 fpm divisions and a lock by means of which the scale reading may be retained until the lock is released.

Aluminum Element Fused Into Glass Features Electric Heater

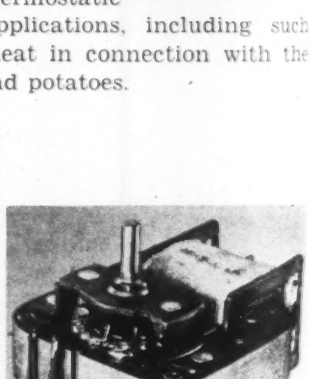


No. 3904**—An "Alodized" radiant glass heat plate, developed by Blue Ridge Glass Corp., is now available as a panel unit from Continental Radiant Glass Heat Corp., 521 Fifth Ave., New York 17.

The heating element is of aluminum and is fused into tempered glass. Designed for use with either a-c or d-c current of 110 or 220 volts, heaters are rated at 1000 watts.

According to the company, the units are ideal for use with thermostatic controls and numerous applications, including such special uses as supplying heat in connection with the storage of tobacco leaves and potatoes.

Shaded, Two Pole Design Used in Small Motor

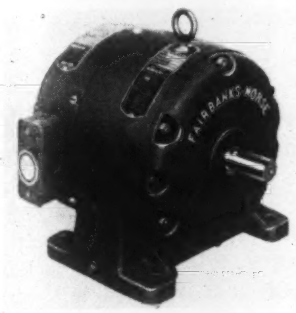


No. 3905—The "Raytheon" model 230 motor has been designed to combine low cost with high electrical efficiency, high starting torque, and high output per pound. It is available from Russell Electric Co., 340 W. Huron St., Chicago 10, Ill.

With horsepowers ranging from 1/350 to 1/75 and starting torques from 1.2 to 4.5 oz-in., this shaded, two pole type motor has a speed of 3400 rpm operating on 40, 50, and 60 cycles at any voltage up to 250.

It is available in skeleton, open, or totally enclosed construction with two internal cooling fans, a dynamically balanced rotor, and self-aligning "Oilite" bearings.

Axial Air Gap Motor Used in New Motor Reducer

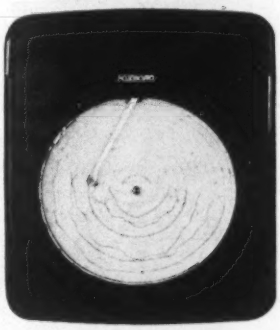


No. 3906—Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, has announced that its axial air gap motor is now available as a motor reducer.

The outstanding feature of the motor is said to be space and weight reduction so that the new unit is an extremely compact gear motor.

Available in ratings from ¾ to 10 hp, these units are symmetrical in design with no separate right hand or left hand assemblies. The motor may also be removed from the gear housing and run separately. The design includes two ratios of single helical gears with hardened and shaved teeth arranged in simple gear trains. Another feature, stressed by the company, is that the motor and gear shafts are parallel, with the centerline of the motor coinciding with the centerline of the low speed shaft.

Recording Instrument Makes Six Records on One Chart



No. 3907—The multirecord "Dynalog" electronic recorder of the Foxboro Co., Foxboro, Mass., is a high speed instrument, completely electronic in principle, making from one to six different records on one circular chart, the records being of colored dots so closely spaced as to make virtually continuous lines.

The recorder has only one measuring system, either resistance bulb or EMF type, but a positive acting switching unit is said to automatically bring the vari-colored pens into recording position at 6 sec intervals, in any sequence desired. The sequence and number of points may be changed at will and complete color coding is used to prevent possible mixup of circuits and pens.

An innovation in the design is the use of a "Rotacolor" pen wheel holding the six recording pens which are magnetically selected in turn and held in recording position by a single pen arm.

The instrument may be used for measurement of temperature, pressure, humidity, liquid level, pH, conductivity, speed, and other process variables.

Window Type Air Filter Has Coated Aluminum Baffles

No. 3908—Specially designed, adhesive coated aluminum baffles are utilized in the "Wind-O-Filter," an extendable aluminum window filter developed by Research Products Corp., 1015 E. Washington Ave., Madison 3, Wis.

Designed to provide year 'round protection against dirt, dust, and pollen in homes, offices, and public buildings, the filter is said to keep the air clear and to

This Trouble-Free PIPE WRENCH Saves You Money

RIDGID Wrenches offer you exclusive advantages that save time, work and cash

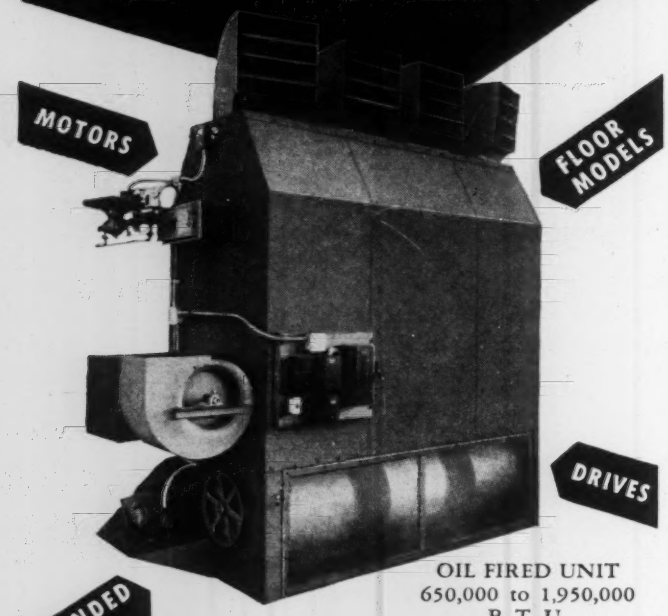
● The important work-saver features which have made RIDGID the outstanding choice of pipe experts all over the world mean fast easy work and real economy for you. Housing is guaranteed against breakage or distortion — no repair expense or bother, ever. Adjusting nut in open housing spins easily in all sizes, 6" to 60." Handy pipe scale on hookjaw. Instant-action non-slip, non-lock jaws. Powerful comfort-grip I-beam handle. RIDGIDs save you time and money. Buy them at your Supply House.

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free
THE RIDGE TOOL CO.
ELYRIA, O.
TRADE RIDGID MARK

RIDGID *Strap Wrench won't mar polished pipe or tubing.*

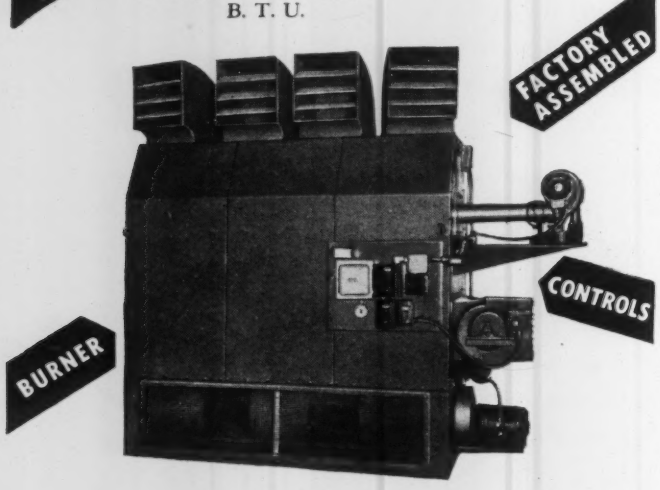
RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

Now! A Complete FACTORY HEATING SYSTEM *is Available for* Immediate Delivery



OIL FIRED UNIT
650,000 to 1,950,000
B. T. U.

GAS FIRED UNIT
650,000 to 1,950,000
B. T. U.



Factory Assembled and Wired
for Immediate Installation.

Write for Bulletin 802 giving complete specifications on Airtherm Direct Fired Heaters.

AIRTHERM
MANUFACTURING COMPANY
711 S. Spring St. Louis

eliminate drafts. Movable extensions make it usable in all standard windows.

Three basic sizes, all 8 in. wide, are extendable from 20 to 26 in., 26 to 32 in., and from 32 to 38 in.

Records Relative Humidity

No. 3909**—A humidity sensitive diaphragm and a clock mechanism are combined in the new type HGS MHY-1 "Microhygrograph" to provide an instrument for measuring ambient humidity in industrial and meteorological fields. The manufacturer, Garden City Instruments, Inc., 608 S. Dearborn St., Chicago 5, states that the unit offers an accuracy of ± 3 percent, is almost instantaneous in response, and may be used to obtain direct readings of relative humidity over 24 hr periods.

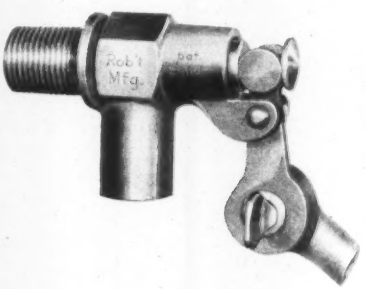
Designed to record small and rapid humidity changes, the instrument is said to be ideal for checking the operation of air conditioning systems and for correlating inside humidity conditions and changes in outside weather conditions which affect the operation of an industrial plant.

Magnetic Gas Valve Is Hermetically Sealed

No. 3910—The K-3H magnetic gas valve offered by General Controls Co., 801 Allen Ave., Glendale 1, Calif., is hermetically sealed and is designed to eliminate the possibility of gummy or foreign matter forming in the solenoid and restricting plunger operation.

Diaphragm construction is used to seal the operator from the fuel gas without interfering with valve operation. The solenoid operator is sealed to the atmosphere to prevent external gas leakage in the event of diaphragm rupture. The unit, which is controlled by a room thermostat, limit control, or similar device, is designed to close automatically upon current failure. It is available in sizes from $\frac{3}{8}$ to $1\frac{1}{4}$ in. IPS.

Maintains Water Level in Evaporative Coolers

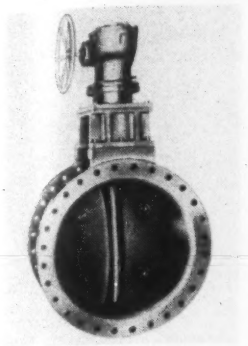


No. 3911**—Production of two new "Bob" float valves, designed to maintain any desired water level in evaporative coolers, has been announced by Robert Mfg. Co., 4004 W. Jefferson Blvd., Los Angeles 16.

The valve can be installed above or below water and has a ratcheted actuating lever designed to maintain the water level for which it is set. The unit which is designed to be submerged is tapped for a ¼ in. pipe thread and is used where extreme alkali conditions re-

quire a submerged valve to prevent corrosion. Shown here is the valve which is mounted above the water level. It is identical to the underwater valve except that the outlet is on top of the latter unit.

Shutoff Valve Designed for Hydraulic Service



No. 3912—Shown here is the class B iron valve, type B-9468, offered by R-S Products Corp., Germantown Ave. at Wayne Junction, Philadelphia 44, Pa.

It is designed for rugged hydraulic service and is equipped with the company's patented rubber spool which, combined with the wedge type closure of the angular seating disc, is said to provide positive shutoff for thousands of full open to full closed cycles. Though it is rated as a 50 lb valve, the company states that it will provide bubble tight shutoff up to 80 psi and commercially tight shutoff at 100 psi.

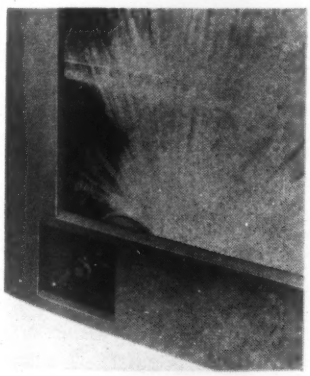
Room Thermostats, Limit Controls Designed for Two Wire Circuits

No. 3913*—The type T-80 room thermostats and the type H-31 high limit control, offered by Crise Mfg. Co., 2040 E. Main, Columbus, Ohio, are designed for operation on a 24 volt, two wire circuit and have current ratings of 0.75 to 0.85 amp.

The room thermostat is of the snap action, open contact, bimetal type. The switch mechanism incorporates silver contact points and permanent magnets. The device has the heat anticipation feature for close control of room temperature.

"Surf-a-stat" is the trademark name for the high limit control which is said to be especially suited for use on gas conversion units, warm air furnaces and hot water boilers. The switch mechanism is bimetal activated, and the silver contacts are completely enclosed. The device is designed for surface mounting and has a temperature range from 100 to 250 F.

Air Washer Designed for Comfort Cooling



No. 3914*—Comfort Products Corp., 2220 S. Lamesa, Dallas 2, Tex., is offering a line of air washers and evaporative coolers which are designed to handle from 3500 to 10,000 cfm.

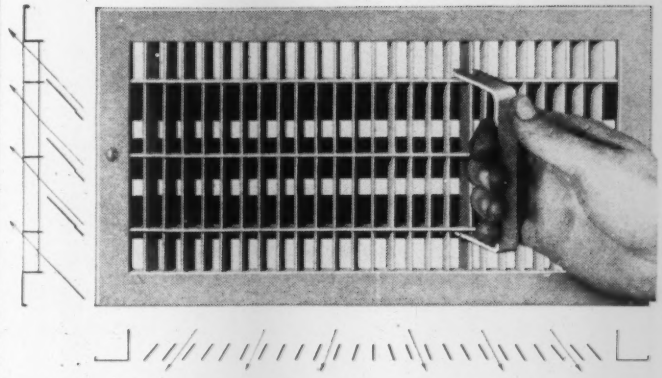
According to the manufacturer, outside air is washed by passing through a foot-thick blanket of water vapor continuously thrown up by a "water flinger" wheel and is then passed through water drenched "Fiberglas" pads. A baffle filter is used to remove solid particles of entrained water.

A 10 to 30 deg reduction in temperature, says the company, is possible with this type of cooling when the air quantities handled are sufficient to provide a complete air change every 2 or 3 min.

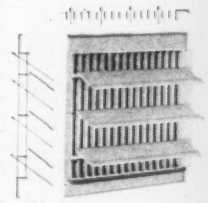
INDEPENDENT

"Fabrikated"

WALL GRILLES WITH DEFLECTING VANES



Style 321-A grille with deflecting vanes



Rear view showing adjustable deflecting vanes

ACCURATE and positive compound deflection of air flows can be readily secured with these "Fabrikated" grilles. Directional adjustments may be made when grilles are installed; or grille bars and vanes may be adjusted after installation to meet unforeseen or changed requirements.

Each grille bar and each deflecting vane is adjusted *individually* with a special two-pronged tool included with each shipment. Locking of grille bars and vanes is not required because they are held firmly in place — no vibration — no rattle.

Write for Our New Catalog No. 48.

MEMBER NATIONAL WARM AIR HEATING INDOOR COMFORT AND AIR CONDITIONING ASSOCIATION

Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.

3747 E. 93rd STREET · CLEVELAND, OHIO

BY INSTALLING TO MARK PROGRESS

LADISH

Controlled Quality

FORGED STEEL FITTINGS

Many costly shutdowns are prevented by using Ladish fittings because forging under rigid laboratory controls improves physical properties four ways:

1. Increases dynamic strength for greater resistance to hydraulic shock pressures.
2. Produces maximum toughness to withstand prolonged fatigue stresses from vibration.
3. Controls grain flow for better protection against expansion and contraction at temperature extremes.
4. Refines grain structure to retard both erosion and corrosion.

Ample stocks . . . complete line . . . size range ⅛ through 4 inches . . . 2000 through 6000 pound ratings . . . Carbon, Alloy and Stainless steels.

Write for Catalog Vol. 2, Today

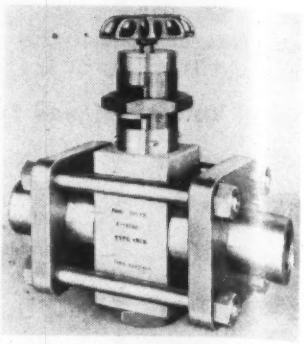
LADISH CO.

CUDAHY, WISCONSIN (MILWAUKEE SUBURB)

District Offices: NEW YORK • BUFFALO • PITTSBURGH • CHICAGO • PHILADELPHIA CLEVELAND • ST. LOUIS • HOUSTON • NEW ORLEANS • LOS ANGELES

STOCKED AND SOLD BY LADISH DISTRIBUTORS IN PRINCIPAL CENTERS

Venturi Design Features Boiler Blowdown Valve



No. 3915**—Based on a venturi ball valve principle, the type VBCB, 1500 lb, continuous blowdown valve offered by Paul Valve Corp., 683 Third Ave., New York 17, N. Y., is said to provide unique advantages in flow characteristics and resistance to erosion.

According to the company, the design utilizes the Bernoulli theorem to force a precision ball into the low pressure center of the stream, and hence into the seat. The body of the valve is machined to the shape of a venturi tube, and the valve tends to close whenever water or steam flows through the venturi. To open the valve, the stem and yoke push the ball down, rolling it out of the seat and into a recess which is designed so that there will be no restriction in the stream. The ball and the inlet and outlet bushings (incorporating the seats) are made of "Stellite".

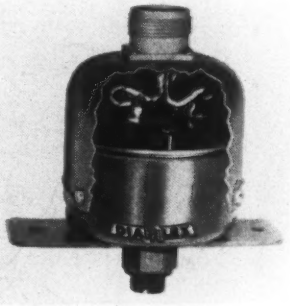
Units are available in sizes from ¼ to 1 in., conforming with the inside dimensions of Schedule 80 pipe. Screwed ends are standard; socket or butt welding ends are optional.

Prevents Freezing, Galling of Metal Surfaces

No. 3916—Developed specifically for high pressure and high temperature (1800 F) applications such as furnace tube heater studs and plugs, C-5 "Hi-Temp" thread compound is offered to prevent freezing and galling of metal surfaces. The compound is available from Felt Products Mfg. Co., Dept. P-21, 1504 Carroll Ave., Chicago 7, Ill.

It is said to greatly minimize shutdowns or dismantling time and to reduce the possibility of stud breakage. It is also said to be noncorrosive when used with stainless steel and other alloy metals and to be suitable for many applications in petroleum refineries, chemical plants, railroads, and other industries.

High Pressure Switch Has Wide Operating Range



No. 3917—The "Hydtrol" high pressure switch offered by Diaphlex Div., Cook Electric Co., 2700 Southport Ave., Chicago 14, Ill., is said to feature linear adjustment over an exceptionally wide operating range from 50 to 5000 psi.

Incorporating a steel diaphragm hydraulically formed and heat treated, the switch has a current rating of 10 amp at 110 volts, a-c, 2 amp at 28 volts, d-c. Switch contacts are snap action, SPDT, and are surrounded by an explosion resistant housing.

The unit is said to be especially applicable to the control of high pressure hydraulic systems containing inflammable liquids or wherever safe, positive control of extreme hydraulic pressures is required.

Three Improvements Made in Design of Dew Point Instrument

No. 3918—Three helpful advantages have been built into the "Alnor Dewpointer" to provide greater operational dependability in measuring dew point, according to Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago 10.

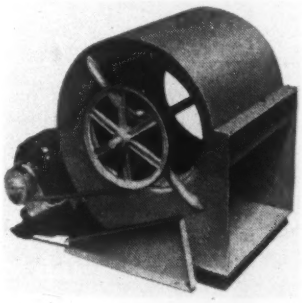
The manometer scale has been made longer to increase the ease and accuracy of reading. Thermopiles now measure the temperature inside the observation chamber. The resistance thermometer tells when the temperature of the gas sample has stabilized to the temperature of the fog chamber.

Develops Condensation Return Units for Many Applications

No. 3919**—Announcement has been made by Roy E. Roth Co., Rock Island, Ill., of a line of condensate return units which are recommended for use with steam plants in office buildings, hotels, and industrial establishments using steam process equipment.

Designed to handle pressures up to 150 psi and radiation up to 35,000 sq ft, units include a turbine pump, an electric motor, a strainer, a float switch or make-up valve, a welded steel receiver, and a heavy steel base. They are manufactured in a number of types, sizes, and models for a wide range of applications. All models are available as duplex units, equipped with two pumps, which provide standby protection or additional capacity if needed.

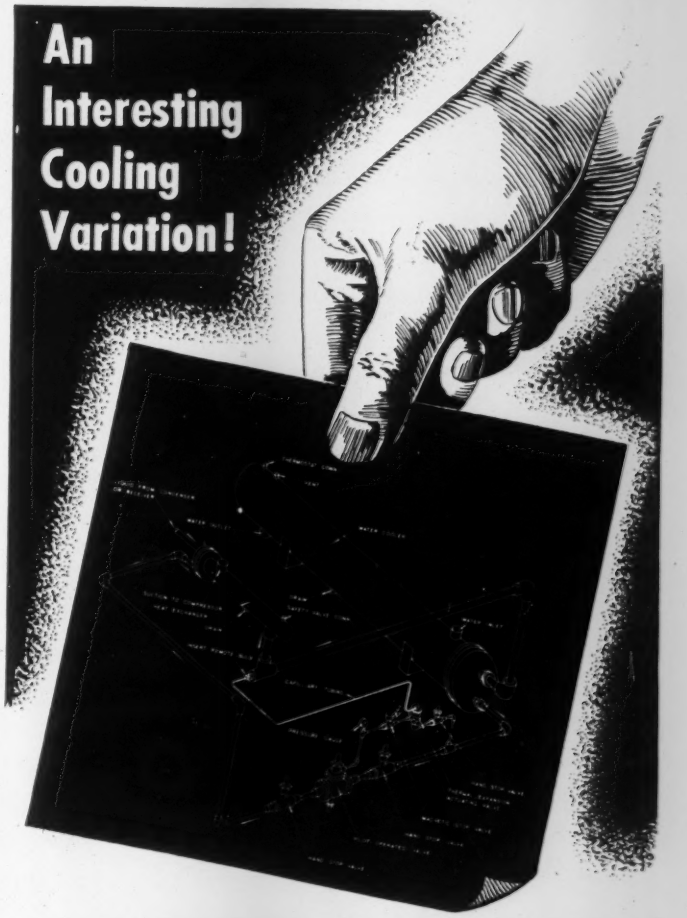
Quiet Operation Features Blower Assembly



No. 3920—A new blower assembly for air conditioner manufacturers has been announced by Viking Air Conditioning Corp., 5600 Walworth Ave., Cleveland, Ohio. The new W-1110 assembly, especially designed for air conditioners, has a capacity of 1000 cfm at ½ to ⅝ in. static pressure.

A feature of the "ultra quiet" assembly is the standardized outlet dimension, making this blower interchangeable with conventional blowers of similar size. It is equipped with streamline bearings and oil cups which are designed to hold a full year's supply of lubricant.

Now in production, units are available to both manufacturers and wholesale distributors in top horizontal, bottom horizontal, or vertical discharge arrangements.



PATTERSON

Freon Water Cooling System with Modulating Liquid Feed

Good feed modulation from 50% to full capacity . . . an ideal arrangement for air-conditioning as well as process cooling where rather wide variations in cooling are required.

This is another of several Patterson Freon Cooler Arrangements, utilizing in this case a cooler, heat exchanger, and pilot operated feed valve actuated by thermal valve.

Are you interested in the details? Do you think this system would take care of your requirement? Our engineers will be glad to check it with you and if not, recommend the system they think would be best. Just let us have the details of your problem and we'll put our many years of experience in cooler design and application to work.

EST 1880

THE PATTERSON-KELLEY Company, Inc.

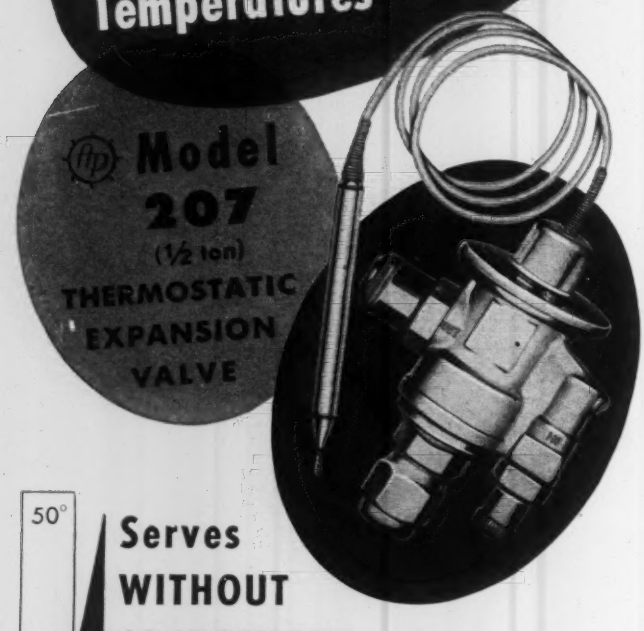
107 WARREN STREET, EAST STROUDSBURG, PA.

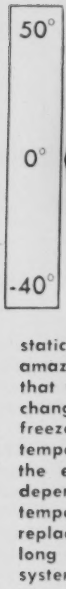
New York Office: 101 Park Avenue, Zone 17

Offices or Representatives in Principal Cities

REMEMBER!

You Need Only This ONE A-P Valve For All Suction Temperatures





Serves WITHOUT ADJUSTMENT on low...to commercial...to air conditioning temperatures

● With a half-ton capacity A-P Model 207 Thermostatic Expansion Valve in your service kit, you're all set for an amazingly wide range of valve applications. You can install that valve — *without* adjustment and without changing or exchanging any parts — on anything from low temperature sharp freezers, ice-cream makers, and dispensing cabinets to medium temperature display cases, and reach-in boxes, and up through the entire air conditioning temperature range. And you can depend on maintaining constant superheat at all these suction temperatures. No wonder the A-P Model 207 is the favorite replacement valve among service engineers today. They have long ago proved its versatility in handling more of the small-system applications (⅛ to ½ ton Freon-12). They have learned to rely completely upon its greater accuracy, supersensitive response, durability and control dependability that mean "performance-insurance" and customer satisfaction.

Standardize on the A-P Model 207 for all your small-unit needs. With its liquid charged power element, it can be installed in any position or ambient temperature, and is easier to adjust, inspect and service. For details, see your Wholesaler, or write for bulletin E-131 or condensed catalog.

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE 10, WISCONSIN
Export Department, 13 East 40th Street, New York 16, N. Y.

DEPENDABLE Refrigeration Valves

R-601C

Stocked and Sold By Good Refrigeration Wholesalers Everywhere . . .
Recommended and Installed By Leading Refrigeration Service Engineers

Equipment Shorts

About 25 students from opposite ends of the earth gathered last month at Worthington Pump & Machinery Corp.'s Harrison works to begin a six months' training course. This international student training program is part of the company's effort "to create and maintain harmonious trade relations in foreign countries" and is open by invitation to those men from abroad who have special qualifications along mechanical or engineering lines.

A new eastern convector-radiator factory of The Trane Co. is now in operation and is said to be the first factory devoted exclusively to mass production of these units. On hand to see the first shipment on its way were Reuben N. Trane, president of the company, and E. A. Cline, manager of the convector sales department. The new Scranton, Pa. plant occupies approximately 70,000 sq ft and is set up to employ about 300 persons at maximum production. R. James Trane, vice president of the company and son of the president, is general manager of the new plant.

American Nickeloid Co. is celebrating its 50th anniversary. A souvenir booklet, recently published to mark the occasion, tells some of the early struggles of the company and the milestones in its progress.

The third annual sales conference of Acme Industries, Inc. was held last month when a large percentage of the firm's representatives and field agents attended the three day meeting. The conference was devoted to equipment, sales policies, and sales promotional activities.

The Bahnson Co. recently conducted two separate classes of one week each devoted to air conditioning. The classes, which were conducted for operating and maintenance engineers of textile mills, covered such topics as refrigeration, air distribution, and controls. Specific subjects under these headings were taught by company engineers and representatives of various companies whose equipment is used in the firm's installations.

A new type hose clamp, applying the principle of sustained tension to a hose connection, is now being manufactured by Corbin Screw Div., American Hardware Corp., New Britain, Conn. The clamp is said to be self-tightening so that it maintains a correct sealing pressure at all times, adjusting itself to all temperatures. It is recommended for use wherever rubber or fabric hose must be connected to metal tubing to carry air, gases, or liquids. Outside diameters range from 7/16 to $2\frac{5}{8}$ in.

Lincoln Electric Co., Cleveland 1, has added to its hard facing line two new tubular type, shielded electrodes: "Faceweld" No. 1 and No. 2. Electrodes previously manufactured under this trade name have been discontinued in favor of the new tubular electrodes which are said to provide a higher consistency to the deposited alloy and a much lower cost.

Electric-Arc, Inc., 152-162 Jelliff Ave., Newark 8, N. J., has developed a new control cabinet which consists of a portable electric pyrometer recorder and/or controller so arranged that six points of heat to 2200 F can be recorded or controlled.

The unit, which is said to be fast-acting, precise, and arranged for simple, electrical on-off control, may be used for semi-automatic program control, for heat cycles, or for completely automatic heat cycle program control.

"Flexfast" is a new low-pressure clamp for use with flexible conduits. The manufacturer, Flexible Tubing Corp., Branford, Conn., states that it provides positive clamping action over diameters from 1½ to 37 in., each size having a wide range of take-up.

The device combines an overlapping one piece, non-rusting metal clamping band with a strap and buckle take-up.

A new type pump scaffold bracket has been developed by Newark Ladder & Bracket Co., Clark (Rahway), N. J. The entire platform, with men and materials, rides up or down on any 4 x 4 (made of two 2 x 4's); a simple brace being used to hold it rigidly upright. It is said to be ideal for the construction and repair of buildings and factories.

The Buckeye Plastic Corp., 1220 Huron Rd., Cleveland, Ohio, is the manufacturer of the "Magno Level." It is a combined level and angle calibrated from 0 to 360 deg, is made of aluminum with wrinkle finish, and incorporates permanent magnets for holding it to metal surfaces. While it is designed for any mechanic, it is said to be particularly adapted to the plumber, steam fitter, welder, or anyone who works with metal.

F. D. Kees Mfg. Co., Beatrice, Neb., has developed the "Protect-A-Plate" to be used in new building construction where joists are notched to recess tubing and wiring of all kinds. The device is a self nailing, 16 gage galvanized steel plate which is said to protect against nail puncturing of piping or wiring through the notch area it covers.

Lectro-Max, Inc., Div. of Magar Home Products, Inc., Geneva, Ill., has introduced an electric motor with a magnetic brake that is designed to provide instant stops. Though manufactured for vending machines, the new motor, identified as No. 1100, is said to be useful for driving other devices. Its main advantage is said to be controlled action, with no "runaway" tendencies. Operating on 105/125 volts, 50/60 cycles, it can be series wound to deliver up to 1/20 hp.

High efficiency, attractive appearance, and quiet operation are said to be outstanding features of the new "Chromalox" electric recessed wall heater offered by Edwin L. Weigand Co., 7500 Thomas Blvd., Pittsburgh 8. Equipped with a built-in thermostat, pressure-type fan, ball-bearing motor, and electric tubular heating units, the new heater is said to be ideal for use where there is a need for extra heat to supplement a main heat source.

Now!

Luminous Flame Model

JOHN ZINK

CONVERSION BURNERS

Available for

IMMEDIATE DELIVERY

LUMINOUS FLAME MODEL

Easy to install. Operates manually or automatically. Burns clean fuel—natural, mixed, manufactured or LP gases—without soot or smoke. Luminous flame radiates heat two to three times faster than a blue flame. Four sizes available for either vertical or horizontal firing.

BLUE FLAME MODEL

Designed to meet the requirements of this type of burner. Capacity range of 100,000 to 200,000 Btu/hr. for operation on natural, mixed or manufactured gases. Manual or automatic operation. Easy to install.

Both types easily cleaned or adjusted

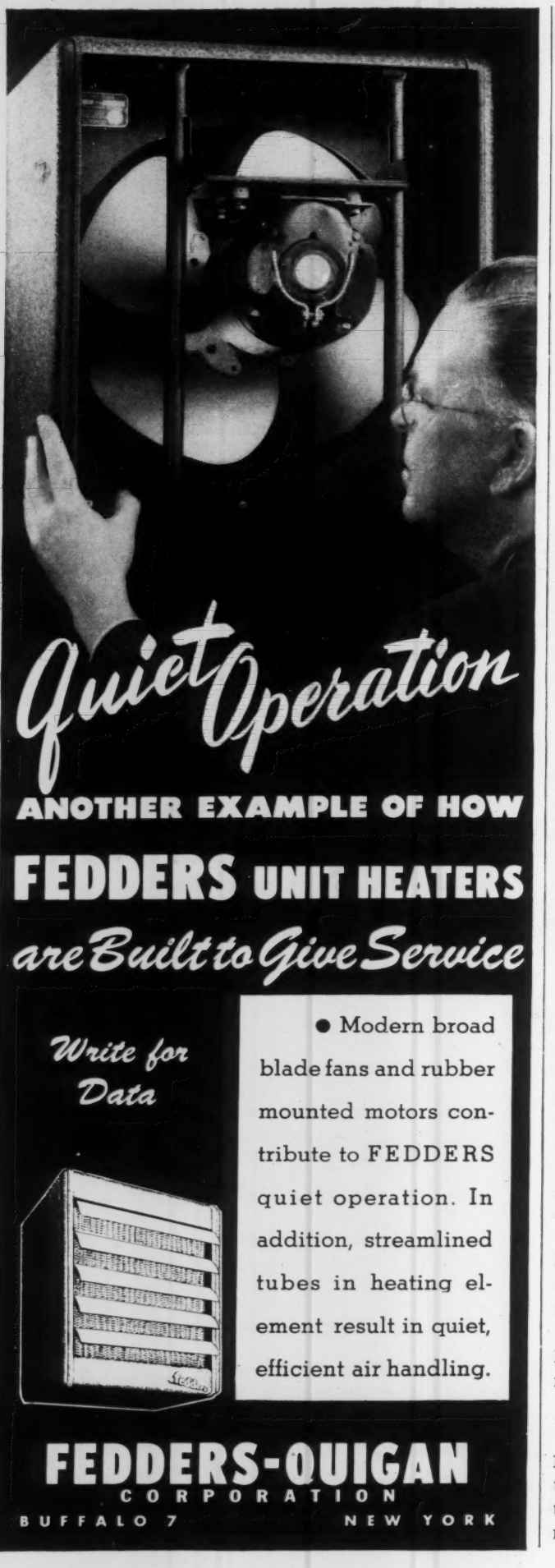
Write for Literature

John Zink Company

4401 South Peoria

TULSA, OKLAHOMA

New York - Salt Lake City - Houston - Los Angeles


Quiet Operation
ANOTHER EXAMPLE OF HOW
FEDDERS UNIT HEATERS
are Built to Give Service
Write for Data
● Modern broad blade fans and rubber mounted motors contribute to FEDDERS quiet operation. In addition, streamlined tubes in heating element result in quiet, efficient air handling.
FEDDERS-QUIGAN
CORPORATION
BUFFALO 7 NEW YORK

EXECUTIVE CHANGES

The appointments of Harry E. Seim as general manager of the Sturtevant division and Tom Turner as general manager of the elevator division have been announced by Westinghouse Electric Corp. Both men will retain their former posts, in addition to assuming their new duties which have been handled by Ellis L. Spray vice president in charge of both divisions. Mr. Spray is retiring from active service.

James C. Tweedell, long engaged in the international field of air conditioning and refrigeration, has joined the New York headquarters' staff of the International Div., Carrier Corp. He entered the refrigeration field 24 years ago and is a director and former president of the Export Managers Club of New York.

Worthington Pump and Machinery Corp. has combined its air conditioning and refrigeration distributor service department and its air conditioning and refrigeration sales division. E. C. Hamilton, with headquarters at Holyoke, Mass., is now responsible for service of all products of the air conditioning and refrigeration division sold through the distributor organization. M. M. Lawler is manager of the division and is located at the company's Harrison works.

The board of directors of York Corp. has elected Marshall G. Munce vice president. His major assignment is representing top management in assisting and supporting the sales organization through trade relations and public relations activities. He joined the company in 1921, and prior to his election was assistant to the president, chiefly as coordinator between the engineering, manufacturing, and sales divisions. These activities have recently been taken over by J. Keith Louden.

D. J. Erikson, who started his career with the Hagan Corp. as a draftsman more than 30 years ago, has been elected president of Hagan and its subsidiary companies, Calgon, Inc., Hall Laboratories, Inc., and Buromin Co. He succeeds J. M. Hopwood who was recently elected to the new position of chairman of the board of directors of the company group.

M. J. Boho, who joined the company in 1936 as a field service engineer, has been elected vice president in charge of sales for the Hagan Corp.

E. W. Butzler, widely known expert on boiler water conditioning and a member of the staff of Hall Laboratories for 20 years, has been appointed to the new position of business manager of the firm.

Owen Rice, former manager of the Calgon Threshold Dept., has been elected vice president in charge of commercial chemical sales, Calgon, Inc.

Dawson J. Burns has resigned as president of Ward Leonard Electric Co. and has been elected chairman of the firm's executive committee. Arthur A. Berard, executive vice president and general manager since 1944, is now president and general manager.

Executive Changes (Cont.)

Ralph M. Hoffman, president of Link-Belt Co., Pacific Div., San Francisco, has been elected a vice president of the parent Link-Belt Co. During his long career, Mr. Hoffman has served in many important executive capacities in both the parent and subsidiary companies. He continues as president of the Pacific division.

The new executive secretary of the Refrigeration Equipment Manufacturers Association is W. Vernon Brumbaugh who succeeds R. K. Hanson, resigned. Mr. Brumbaugh is a veteran in the trade association field, having had 22 years' experience with national associations representing manufacturers and distributors. He is located at the headquarters office of REMA.

General Engineering and Manufacturing Co. has appointed Arthur E. Cullen regional manager of its north central territory consisting of northern Illinois and Indiana, Michigan, Ohio, and western Pennsylvania. Mr. Cullen has been director of purchases since February 1947.

A. F. Vinson, formerly assistant production manager, General Electric Co., Apparatus Dept., and chairman of the GE welding committee, is now manager of the company's welding divisions. He is responsible for the operation and management of personnel and facilities, and for the development, design, manufacture, sales direction, and promotion of all company welding products.

Allis-Chalmers Mfg. Co. has promoted B. F. Bilsland from manager of its Chicago district office to manager of the newly formed midwest region. The new region, eighth under a long range sales and expansion program launched in 1945, embraces six midwest district and six branch offices.

Establishment of a Pacific coast division of Owens-Corning Fiberglas Corp. and the appointment of L. R. Kessler as its general manager have been announced. According to the company, this separate division will handle construction, manufacturing, and sales operations of the company in the Pacific coast area and neighboring western states. Construction of a new plant at Santa Clara, Calif., is now well under way and production of thermal and acoustical insulation is scheduled to start next July.

Henry Valve Co. has opened a west coast office and warehouse at 736 E. Washington Blvd., Los Angeles. In charge of Richard S. Dawson, western district manager, the branch will serve the Pacific coast, Idaho, Nevada, and Arizona. Emergency warehouse stocks will be maintained.

The appointment of Burton T. Kehoe as general attorney for Carrier Corp. in Syracuse, N. Y., associated with Herman Seid, counsel for the corporation, has been announced.

A BETTER Strainer to "police your pipelines"

- **FIRST**—*The Screen*, a high-grade woven Monel wire basket that catches solids—lets condensate, oil or other fluids flow freely.
- **SECOND**—*Finish*. Cadmium plated for protection against corrosion and for better appearance.
- **THIRD**—*Easily Cleaned*. Blow-off bushing made for easy removal. Bushing and screen come out together. Screen automatically aligns on reassembly.
- **THOUSANDS IN SERVICE**—Sold by 150 Mill Supply Houses.

6 sizes from ½" to 2" for pressures up to 600 lb. Reasonably priced. See your supply house or write for Bulletin S-201.

YARNALL-WARING COMPANY
107 MERMAID AVENUE • PHILADELPHIA 18, PA.

YARWAY STRAINERS

BARBER COLMAN

ZONE CONTROLS

Econostat

OFFERS GREAT FLEXIBILITY

The ECONOSTAT governs a motor-operated zone valve or primary heating controls.

The ECONOSTAT is recommended where control from an inside thermostat is impossible or impracticable and zone control based on *outside* temperature is best suited to the heating system requirements. The ECONOSTAT will supply heat at varying intervals or cycles in proportion to outdoor temperatures, and hence in proportion to the varying heat loss from the building. Automatic compensation for heating system lags is an *exclusive* feature of the Barber-Colman control system. Adjustments provide for automatically lowered night temperature, morning warm-up, and Sunday and holiday omissions.

PANEL HEATING

AND OTHER HOT WATER CONTROL SYSTEMS

Thermostatic Adjuster and Hot Water Microtherm, typical units used in hot water control systems.

Write today for this new ZONE CONTROL Bulletin. It discusses comprehensively the various Barber-Colman systems and their useful applications. Ask for F-3718.

Barber-Colman temperature control systems are available for all hot water heating installations—from the simplest convector type of a residence heating plant to the most elaborate kind of a panel job for a modern multiple-occupancy building. Elements available include on-off controls, *proportioning (mixing) controls,* automatic outside-temperature reset of water temperature, primary and secondary control circuits, and zone modifications and other refinements. Your Barber-Colman representative is qualified to discuss all types of hot water controls with you. Get in touch with him.

BARBER-COLMAN COMPANY
1228 ROCK ST., ROCKFORD, ILLINOIS

Executive Changes (Cont.)

C. E. Tweedle, assistant to the president of Ast[illegible]nia Regulator Co., has been elected vice president o[illegible] the company. Prior to his association with the firm in 1946 he served in the U. S. Navy as commander and was executive officer of the administration command, Great Lakes Naval Training Center. Prior to the war he was engaged in consulting engineering.

DeBothezat Fans, Div. of American Machine and Metals, Inc., has announced the appointment of Harold L. Mooney as director of market research. Mr. Mooney has a background of more than 20 years' experience in market research and in the development of manufacturing, trade, and consumer research techniques.

George W. Perry is the new advertising manager of Cook Electric Co. He is an alumnus of the Harvard graduate school of business administration.

Formation of the Hamilton-Thomas Corp., Hamilton, Ohio, to operate Economy Pumps, Inc., Klipfel Mfg. Co., and Liberty Planers, Inc., manufacturing divisions of Hamilton, has been announced by officers of the newly formed corporation. Officers of the firm include Richard Thomas, president; L. G. Thomas, executive vice president; H. R. Ryan, vice president; R. H. Thomas, Jr., vice president; E. T. Drinkuth, secretary; and L. V. Thomas, treasurer.

Hugh M. Kanagy, a member of the Crane Co. sales training dept. for the past few years, has been appointed assistant manager of the advertising and sales promotion dept.

Research Products Corp. has elected R. E. Onstad president of the company. He succeeds Kemper Slidell who will retain his connection with the company as a member of the board of directors.

In line with its expanding advertising program, Bryant Heater Co. has named Howard A. Kennedy as advertising manager for consumer products. He succeeds Fred O. Habegger who recently became sales manager of Bryant-Williams Co.

Edward R. Zieve, former assistant manager of the air conditioning dept., Clarage Fan Co., is now associate professor of air conditioning in the Milwaukee School of Engineering's Refrigeration, Heating, and Air Conditioning Institute. New to the institute's department of heating, as associate professor, is Milton R. Paulsen. Ernest S. H. Baars is the new head of the refrigeration department, and Charles J. Berthet is now acting head of the heating department.

Dan Mandery has been named to head the Platecoil Div., Kold-Hold Mfg. Co., Lansing, Mich. His background includes many years of experience in refrigeration, heating, and air conditioning, covering both sales and service.

NEW BOOKS & REPORTS

Navy Ventilation Test Calculator Now Available to Public

A simple, rapid ventilation testing calculator, developed by the Navy primarily for ship construction and alteration, is now available to the public for use in testing and balancing heating, ventilating, and air conditioning systems.

Systems utilizing round ducts are commonly used by the Navy and balancing is accomplished by the insertion of round orifices at flanged joints. The determination of the proper orifice size is tedious, either by the cut and try method or by inserting a temporary flat plate so as to restrict a portion of the duct and then calculating the equivalent orifice size. This slide rule is used to determine the equivalent orifice size after the system or branch has been balanced by the use of temporary flat plates to reduce duct areas at certain points.

Scales are also provided to determine the relationships between rectangular duct dimensions and equivalent round ducts, as well as velocity, duct area, and diameter. In addition, C and D scales are provided for performing multiplication and division.

The instructions furnished with the calculator include the basic equations for computing air volume and velocity, information on the use of direct reading air velocity meters and anemometers, and methods of taking observations. While the instructions are taken from the Navy ventilation standards, they should be of interest to those engaged in testing and balancing commercial and industrial heating, ventilating, and air conditioning systems as they describe a testing procedure which is recommended by the Navy and which is said to require a minimum of time and effort.

The slide rule, Ventilation Testing Calculator (PB 89769s), together with 10 pages of illustrated instructions, is priced at $1.50 and may be ordered from the Office of Technical Services, Department of Commerce, Washington 25, D.C. A check or money order should be made payable to the Treasurer of the United States.

Asks Comment on Simplified Practice for Copper, Brass Pipe

The standing committee in charge of reviewing Simplified Practice Recommendation R217-46, Copper Water Tube and Copper and Brass Pipe, has approved a revision of it and copies have been mailed to producers, distributors, and users for acceptance or comment, according to an announcement by the National Bureau of Standards.

Purpose of the revision is to bring the recommendation in line with current requirements by adding three sizes of type M tube, for use in waste, soil, and vent lines and ¼ in. type L tube. A 12 ft straight length of tube has been added and the scope of the program has been broadened to include recommended uses for the three types of tube covered, as well as dimensional tolerances.

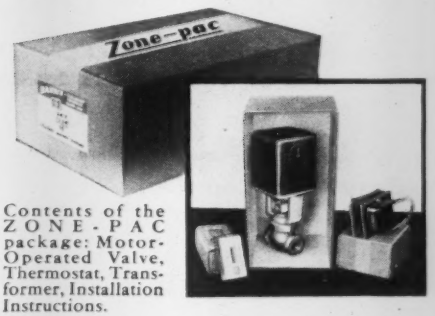
Mimeographed copies of the proposed revision may be obtained from the Commodity Standards Div., National Bureau of Standards, Washington 25, D. C.

BARBER COLMAN

ZONE CONTROLS

Zone-pac

PACKAGE PROVIDES ALL NECESSARY UNITS



Contents of the ZONE-PAC package: Motor-Operated Valve, Thermostat, Transformer, Installation Instructions.

This simple and practical control system will regulate the heat supply to one or more radiators as the motor-operated zone valve responds to the demands of the heat-anticipating thermostat. Heat anticipation minimizes overheating and other effects of the lags inherent in ordinary radiator systems. ZONE-PAC units supplement the primary controls of any heating system to provide uniform, comfortable space temperature with minimum fuel consumption. The system is applicable to many types and sizes of buildings.

COMPENSATED CONTROL OFFERS FURTHER REFINEMENT

The Varitherm — distinctive and *exclusive* feature of Compensated Control.

The Varitherm — a *variable-limit* thermostat — provides still more uniform temperature, and consequently greater economy, by further reducing heating system lags. (All heating systems are of necessity designed for extreme conditions, and hence tend to overshoot in mild and average weather.) It controls only the heater in the heat anticipating thermostat, but its action *varies* as the heat stored in the system changes. This *exclusive* Barber-Colman feature automatically compensates for a wide range of conditions, and in a simple manner produces extremely close temperature control. For details of application on ZONE-PAC and COMPENSATED CONTROL, consult your Barber-Colman representative.

Write today for this new ZONE CONTROL Bulletin. It discusses comprehensively the various Barber-Colman systems and their useful applications. Ask for F-3718.

BARBER-COLMAN COMPANY
1228 ROCK ST., ROCKFORD, ILLINOIS

Activated Carbon Used for Control of Odors in Air

The use of activated carbon for purifying, deodorizing, and general cleaning of air in ventilating and air conditioning systems is the subject of the latest brochure published by the American Society of Refrigerating Engineers.

Written by F. H. Munkelt, vice president, W. B. Connor Engineering Corp., the article contains basic information on the control of odors in air conditioning, including the selection and installation of equipment. Data are included on average odor free air requirements for the dilution of odors to threshold requirements.

This eight page application data sheet is identified as AD 42 and copies are available from ASRE headquarters, 40 W. 40th St., New York 18, for 45c.

Test Methods and Specifications for Coal and Coke Compiled by ASTM

Through the work of its committee D-5 on coal and coke, the American Society for Testing Materials has issued a number of standard methods of testing and has developed numerous specifications for coal and coke. These have been published in convenient form and a number of changes made during the current year and certain new material have been included in a special compilation.

Test methods and procedures pertaining to coal cover sampling, analysis for volatile matter in connection with smoke ordinances, grindability, drop shatter test, tumbler test, screen analysis, size, sieve analysis, cubic foot weight, index of dustiness, and free swelling. Specifications cover classification of coals by rank and grade.

An appendix gives several proposed methods which committee D-5 is studying. These include tests for expansion pressure of coal during coking, for plastic properties of coal by the Davis type plastometer, for plastic properties of coal by the Gieseler type plastometer, for carbonization pressure of bituminous coal, and for pressures developed during carbonization of coal by the movable wall oven, as well as tests for pressures, strains, and other properties developed during carbonization of coal.

Copies of this paper covered booklet, ASTM Standards on Coke and Coal, can be obtained from society headquarters, 1916 Race St., Philadelphia 3, for $2.

Lists Degree Hours Above 80 F in Cooling Bulletin

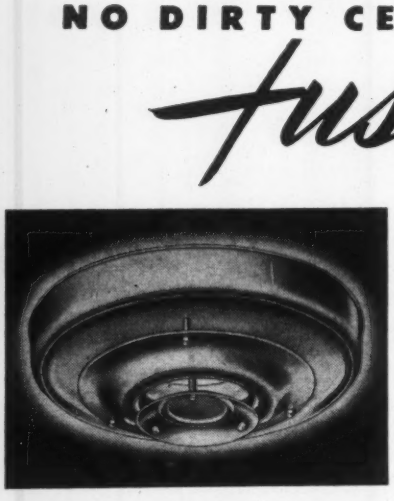
A special summer cooling bulletin lists the degree hours above 80 F in the city of Minneapolis during July. In addition to the daily and total degree hours, maximum daily temperatures for both this season, last year, and a normal season are shown. Separate listings give the total July degree hours for each year, as far back as 1905, and the number of days during July (from 1945-48) that the maximum temperature was above 80 F.

Published by Waterman-Waterbury Co., 1122 Jackson St., N.E., Minneapolis 13, this data sheet is part of the company's regular degree day bulletin, the subscription rate for which is $1.75 per yr.

Type "RE" FUSEAIR ◆

Type "SE" FUSEAIR ◆

NO DIRTY CEILINGS WITH *fuseair*



CEILING OUTLETS

AVAILABLE FOR PROMPT DELIVERY

Write for Bulletins today

● The problem of ceiling discoloration has been effectively minimized by the development of Type "SE" FUSEAIR. The extended moulding design-feature of this unit will assure your customers a tremendous saving in redecorating costs.

ALADDIN HEATING CORPORATION

2222 SAN PABLO AVE., OAKLAND 12, CALIFORNIA

MEETINGS & CONVENTIONS

Refrigeration Service Engineers Society, 433 N. Waller Ave., Chicago 44—11th annual convention, November 19 to 22. Hotel Sherman, Chicago. The third annual regional educational exhibit, sponsored by the Refrigeration Equipment Manufacturers Association, will be held in conjunction with the meeting and the 125 exhibits will occupy the mezzanine floor of the hotel.

The 18th National Exposition of Power and Mechanical Engineering, November 29 to December 4, Grand Central Palace, New York City—will include over 400 exhibits of the latest equipment for the production, distribution, and application of power and heat. The general public is not invited and admission will be by invitation and registration. The show is under the management of the International Exposition Co., Grand Central Palace.

American Society of Refrigerating Engineers, 40 W. 40th st., New York City—1948 annual meeting. December 5 to 8, Hotel Statler, Washington, D. C.

The technical program will be under the supervision of C. M. Ashley, chairman of the program committee, and W. S. Woodside will be the convention chairman.

Fifteen technical papers, covering such subjects as food freezing, design developments in household and small commercial refrigerators, and unusual refrigeration applications, are scheduled for presentation. A feature of this meeting will be a domestic refrigerator forum.

National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland 14—35th annual convention, Hotel Cleveland, Cleveland, December 9 and 10. Current problems and the industry's overall objectives will highlight the meeting.

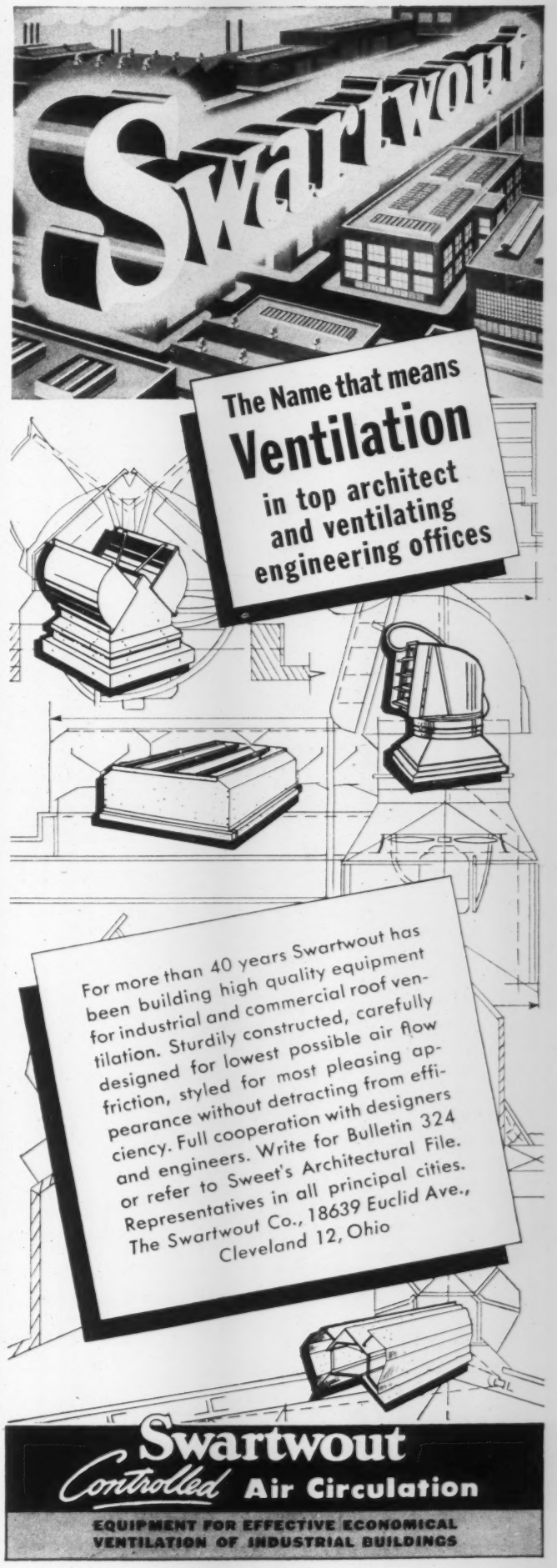
Ninth International Heating, Ventilating, and Air Conditioning Exposition, January 24 to 28, International Amphitheatre, Chicago—under the auspices of the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York City.

Under the management of the International Exposition Co., Grand Central Palace, New York 17, this event will be the largest of its kind ever held, according to Charles F. Roth, show manager.

American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York City—the 55th annual meeting, January 24 to 27, 1949, Stevens Hotel, Chicago.

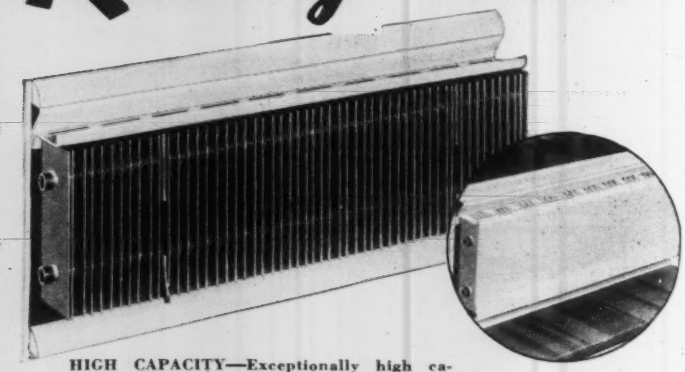
The Illinois Chapter will be host for the occasion and W. A. Kuechenberg is in charge of arrangements. For additional information see ASHVE Journal Section in this issue.

National Heating Wholesalers Association, 239 Water St., Pittsburgh—annual convention and membership meeting, January 25, Blackstone hotel, Chicago. Dick Colegrove, association secretary, has urged members to


Swartwout
The Name that means
Ventilation
in top architect and ventilating engineering offices
For more than 40 years Swartwout has been building high quality equipment for industrial and commercial roof ventilation. Sturdily constructed, carefully designed for lowest possible air flow friction, styled for most pleasing appearance without detracting from efficiency. Full cooperation with designers and engineers. Write for Bulletin 324 or refer to Sweet's Architectural File. Representatives in all principal cities.
The Swartwout Co., 18639 Euclid Ave., Cleveland 12, Ohio
Swartwout
Controlled Air Circulation
EQUIPMENT FOR EFFECTIVE ECONOMICAL VENTILATION OF INDUSTRIAL BUILDINGS

Designed for Better Living . . .

Rittling BASEBOARD HEATING

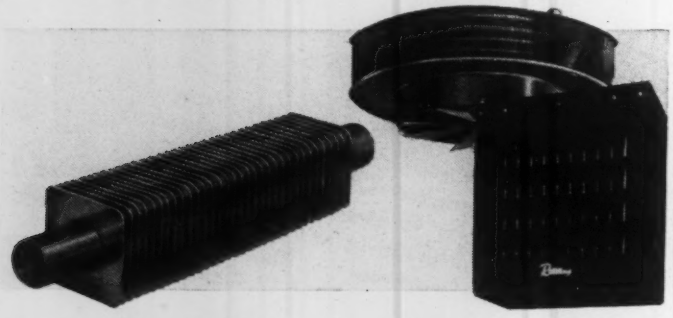


HIGH CAPACITY—Exceptionally high capacity per lineal foot (600 BTU with 170° water) permits operation most of the time on low water temperature; thus effecting fuel economy, draftless distribution and increased wall cleanliness.

SIMPLE INSTALLATION—(Does not have to be recessed.) Requires only a few wall brackets and fittings.

DURABLE CONSTRUCTION—Heavy wall copper tubing, aluminum radiating fins and heavy gauge sheet steel grilled covers.

Immediate Delivery *Write for Catalog B1*



MAGNA Fin CONVECTORS
Write for Catalog MFC

MAGNA Therm UNIT HEATERS
Write for Catalog MTH

THE Rittling CORP.

Manufacturers of Fin Tube Surfaces. Inquiries Invited.

1292 NIAGARA ST. BUFFALO 13, N. Y.

Meetings and Conventions (Cont.)

secure early reservations from the hotel because of a probable scarcity of accommodations.

Stoker Manufacturers Association, 307 N. Michigan Ave., Chicago—plans have tentatively been made to hold a one day membership conference in Chicago during the last week in January.

American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.—the following 1949 meetings have been scheduled:

Spring meeting and ASTM committee week, Edgewater Beach hotel, Chicago, February 28 to March 4.

Fifty-second annual meeting, Chalfonte-Haddon Hall hotel, Atlantic City, June 27 to July 1.

First national meeting of the society on the west coast, Fairmont hotel, San Francisco, October 10 to 14.

American Foundrymen's Society, 222 W. Adams St., Chicago—1949 annual meeting, May 2 to 5, St. Louis, Mo.

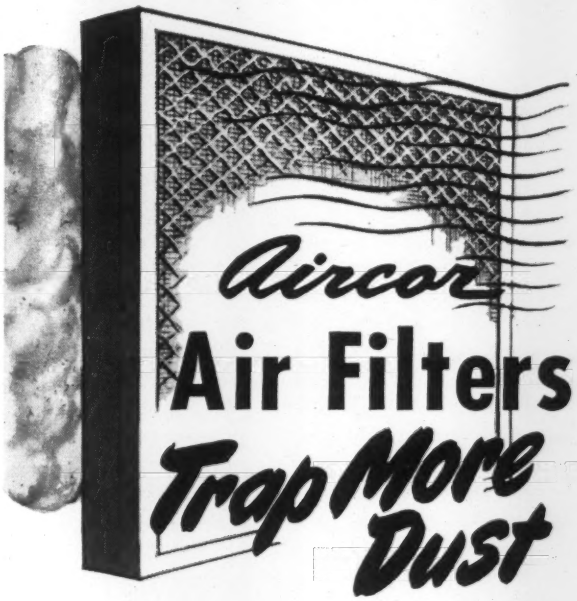
Oil-Heat Institute of America, 6 E. 39th St., New York City—1949 national convention and National Oil-Heat Exposition, May 16 to 20, Boston. The convention committee has approved Mechanics Hall for the exposition and the Statler as the headquarters hotel.

American Society of Refrigerating Engineers, 40 W. 40th St., New York City—Proposed 1949 Spring meeting, June 5 to 8. As tentatively planned, the technical sessions and committee meetings will be held aboard ship and will be combined with a cruise, from Montreal, on the St. Lawrence and Saguenay rivers. Stops for sightseeing will be made at Murray Bay, Tadoussac, and Quebec.

The 4th International Gas Conference, June 15 to 17, London, England—sponsored by the International Gas Union which is comprised of national gas associations throughout the world. Papers and discussions will cover all phases of gas making, including manufacture, distribution, utilization, research, and statistics. Participants at the conference are also invited to attend the 86th annual meeting of the Institution of Gas Engineers, to be held in London, June 13 and 14. Additional information may be obtained from the American Gas Association, 420 Lexington Ave., New York 17.

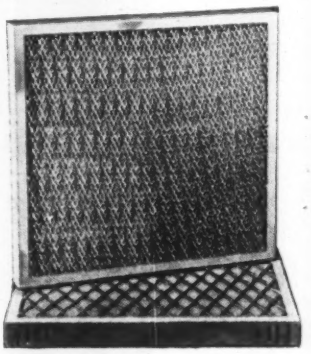
Sixth All-Industry Refrigeration and Air Conditioning Exposition, the week of November 14, 1949, Atlantic City—sponsored by the Refrigeration Equipment Manufacturers Association, 1107 Clark Bldg., Pittsburgh 22, Pa.

A shipment of 20 oil fired winter air conditioners to Tokyo, Japan, was recently made by L. J. Mueller Furnace Co. These units are to be installed in a housing project for Northwest Airlines personnel.



Aircor Air Filters Trap More Dust

For Air Conditioning, Heating and Ventilating



Greater efficiency—lower resistance is yours with an AIRCOR Air Filter.

A permanent, cleanable viscous type filter of all galvanized construction, having full bronze welded corners. Expanded metal face plate acts as lint arrestor to provide easier cleaning and servicing. Rated filtering efficiency 98.5%. In standard 1″ and 2″ thickness.

Also available for heavy duty service on industrial and special applications—in 2″ to 4″ thickness. Holding frames (for V-type or straight banks) are made for all type filters.

SEND FOR BULLETINS →

Air Filter Corporation

108-F NORTH WATER ST. • MILWAUKEE 2, WIS.

Canadian Representative
DOUGLAS ENGINEERING CO., LTD., MONTREAL

Aircor

CASE REPORT No. 52 from a series of actual cases recording the successful application of "BEAR" DY-NAMIC BALANCING to Industry.

BLOWER WHEELS FOR OIL BURNERS BALANCED IN LESS THAN 2 MINUTES!

MT. HAWLEY MFG. CO., PEORIA, ILL., reports: With this "Bear" Dy-Namic Balancing Machine, Model 340-R, blower wheels ranging in size from 5" to 9" diameter, are balanced in an average time of 1 minute and 42 seconds. Result: Much quieter and smoother oil burner performance!

Dy-Namic Balance FASTER! for Quieter, Longer Life Performance

You can obtain improved product performance and elimination of noise and vibration at LOWER COST through this *faster* "Bear" Dy-Namic Balancing Method. Lower initial capital investment and a low cost-per-unit are made possible by this revolutionary "Bear" Method. These Dy-Namic Balancing machines are being used throughout industry during the manufacturing process, as well as for maintenance operations. With "Bear", Dy-Namic Balancing is speeded up to a point where the operation hardly interrupts routine production . . . simplified to a point where men and women learn to Dy-Namically Balance rotating parts in just a few hours.

Some typical applications of "Bear" Dy-Namic Balancing in the Heating, Piping and Air Conditioning fields

Air Conditioning Fans
Blower Wheels for oil burners
Blower Unit Heaters
Centrifugal Pumps
Circulating Pumps
Draft Fans
Exhaust Fans
Propeller Heating Units
Pump Impellers
Refrigeration units and equipment
Steam Generators
Sheaves
Unit Heating Systems
Ventilating Fans

SEE DY-NAMIC BALANCING MANUAL FOR MANY MORE APPLICATIONS!

FREE MANUAL tells you how!

Send now for this FREE, fact-packed 22-page Dy-Namic Balancing Manual for rotating parts weighing from 4 oz. to 8 tons! Write: Bear Mfg. Co., Dept. H-16, Rock Island, Illinois.

BEAR

STATIC AND *DY-NAMIC BALANCING* MACHINES

2967-HP

Trade Mark Reg. U. S. Pat. Off.

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 181. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Agitators, Tanks, Degreasers, and Dryers

No. 7025—A four page folder, issued by Randall Mfg. Co., Inc., 410 E. 93rd St., New York 28, briefly describes some of the company's diversified products. Washing machines, degreasers, a cleaner tank, an immersion heater tank, an agitator, and a chrome plating tank are among the products illustrated. Other equipment items briefly listed include air heaters, gas burners, heating coils, controls for gas, electric, or steam heating, and exhaust and dust collecting systems.

Alloy Plug Valves

No. 7026—An illustrated 12 page folder (No. 577) introducing the "Renewo" valve threesome is now available from Lunkenheimer Co., Cincinnati 14. This new literature illustrates, in cutaway fashion, the interchangeability of parts by which users of regular type "Renewo" valves can convert to either nickel alloy or stainless steel plug type valves by changing seats and discs. The complete line includes globe and angle types rated at 200 and 300 lb steam pressure.

Aluminum Alloys and Mill Products

No. 7027—Reynolds Metals Co., 2500 S. Third St., Louisville, has published a new pocket sized data book on aluminum alloys and mill products. Information given on the company's products covers such factors as tempers, shapes, sizes, and physical, chemical, and mechanical properties, as well as fabricating characteristics. The booklet contains 163 tables and 33 pages of explanatory text covering a wide range of related subjects, including alloy and temper designation systems, heat treatable and non-heat treatable alloys, casting alloys, casting methods, and foundry practice. In addition, wrought aluminum mill products and methods of producing them are described. Fabricating methods discussed include blanking, drawing, stretch forming, spinning, embossing, coining, stamping, bending, machining, forging, welding, etc. A section on surface finishes and another on aluminum pig and ingot products are also included. This 6 x 9 in., wire bound booklet is available without charge to those engineers, designers, and technical men who send in a request to the manufacturer on their company letterhead. The price to all others is $1.00 per copy.

Automatic Controls for Industry

No. 7028—Some of the many ways in which its automatic controls are being used in industry are outlined in

KRITZER RADIANT COILS

Illustration shows workman soldering connections on coil run. Coils are suspended in soldering position and then moved up into installed position immediately below joists.

Kritzer Radiant Coils, Inc., has developed a radiant coil for circulating hot water systems that has revolutionized the field of radiant heating. Interest in this phase of heating has risen tremendously within recent years, and has set in motion a new trend toward radiant heat which has made this one of, if not the most popular subject in news of the building trade. These finned coils are an adaptation of the finned coil principle which has been used in the refrigeration industry for many years with great success. Constructed entirely of non-ferrous metals, copper and aluminum, they are light in weight and will last the life of the structure. The low original cost and simplicity of installaton make Kritzer Radiant Coils the most desirable form of radiant heat on the market today.

See for yourself how Kritzer Radiant Coils will enable you to complete jobs faster. Additional information is available . . . write us today.

"IF IT'S KRITZER, IT'S RIGHT, SIR!"

KRITZER RADIANT COILS, INC.
2901 Lawrence Ave., Chicago 25, Ill.

weil "TVC" LOW RETURN CONNECTION CAST IRON RECEIVER

GUARANTEED PERFORMANCE

- *Precision-built for longer life*
- *Every pump part made and assembled in the Weil Factory*
- *Pre-tested before shipping*
- *Pump comes completely assembled*

TYPE R
Hot and Chilled Water Circulating

Ball-bearing — once a year lubrication
Capacity — 10 to 750 GPM
(write for bulletin R5500)

TYPE TR HORIZONTAL
Low and High Pressure Systems

Ball-bearing — heavy duty
Capacities to 100,000 sq. ft. E.D.R.
Pressures to 125 P.S.I.

Low return connections provide freedom of layout. Eliminates underground lines. Overhead lines may be used. Has extremely low waterline—cast iron receiver. Capacities—500 to 10,000 sq. ft. E.D.R.
(write for bulletin TVC-300)

TYPE "TVC" CONDENSATE
LOW PRESSURE SYSTEMS

Fig. 302

weil PUMP COMPANY 1528 North Fremont Street Chicago 22, Illinois

Now Only $2.00 for This Outstanding Book on Air Conditioning

The Third Edition of

AIR CONDITIONING FOR COMFORT

by SAMUEL R. LEWIS

288 Pages—6½" x 9¼"—Cloth Bound

Easy to understand . . . accurate . . . comprehensive . . . these are the features of this third edition of Samuel R. Lewis' well-known AIR CONDITIONING FOR COMFORT.

Fundamentals are fully and clearly covered. Correct procedure in designing complete systems for both residences and large buildings is explained step by step. In addition, considerable original data on such subjects as standards, noise control, measurements, and fire protection codes has been included.

Send $2.00 for a copy today to the address below. We know you will consider this one of the finest air conditioning books you have yet seen, but if you should be dissatisfied with it for any reason whatever, your money will be promptly returned to you.

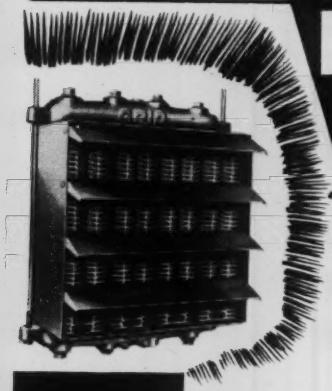
KEENEY PUBLISHING COMPANY

6 No. Michigan Avenue Chicago 2, Illinois

IS IT SUMMER AT YOUR CEILING?

But WINTER ON YOUR FLOOR?

INSTALL GRID UNIT HEATERS THAT...



...GIVE YOU WARM AIR IN GREATER VOLUME AT THE WORKING LEVEL-

HIGH TEST CAST IRON HEATING SECTIONS

GRID Unit Heaters are designed for low outlet temperatures and more air delivery to the floor level—not the ceiling.

Any unit heater that fails to deliver warm air to the floor level where it is needed most is simply wasting heating dollars to heat that part of the building that does not require heating.

Are you spending your heating dollars only to heat your ceiling? Don't be confused by unit heaters with great BTU delivery and high outlet temperatures.

BTU rating in a unit heater does not mean everything. It is the CFM and low outlet temperature that really count. If you want to provide uniform heat—and save on your fuel bill—install GRID Unit Heaters this heating season. GRID Unit Heaters have been used sucessfully for 17 heating seasons in all types of plants, in all kinds of atmospheric conditions.

• GRID heating sections are one piece construction high test cast iron—the metal for permanency . . . no electrolysis because there are no dissimilar metals used in GRID construction. Hence, no maintenance expense—but years of trouble-free heating service.

Write

Write today for complete details, capacity tables—the story of GRID to:

D. J. MURRAY MANUFACTURING CO. WAUSAU, WISCONSIN

a 40 page catalog (ND4A-1) recently issued by L[illegible]ds & Northrup Co., 4934 Stenton Ave., Philadelphia 44. The company's instruments described are said to be applicable to almost any process which can be controlled by moving a valve, vane, or damper. Electric controls of the "Position-Adjusting" type are featured.

Cellular Glass Insulation for Low Temperature Use

No. 7029—Pittsburgh Corning Corp., 632 Duquesne Way, Pittsburgh, has issued a four page brochure on the use of "Foamglas" cellular glass insulation for low temperature work. Properties, recommended techniques for various applications, and advantages are covered.

Centrifugal Fans of the Nonoverloading Type

No. 7030—Type LL "Limit-Load" conoidal fans are thoroughly covered in a new 68 page bulletin (No. 3675) issued by Buffalo Forge Co., Buffalo, N. Y. In addition to describing design and construction features, the booklet provides detailed information on arrangements, fan bases, materials of construction, dimensions, weights, and performance characteristics, as well as fan selection tables. These nonoverloading centrifugal fans have a double curved blade rotor and stationary directional inlet vanes.

Check Valves

No. 7031—"Chex-Flo" check valves of the expansible tube type, which are designed for use with air, gas, oil, or water, at temperatures up to 150 F, are described in Bulletin 610-B issued by Grove Regulator Co., 65th & Hollis Sts., Oakland 8, Calif.

Cleaning Plugs and Inserts for Condensers, Heat Exchanger Tubes

No. 7032—"Conco" cleaning plugs, which are designed for cleaning algae deposits and scale deposits on the inside of condenser and heat exchanger tubes, are briefly covered in a new bulletin published by Condenser Service & Engineering Co., Inc., 95 River St., Hoboken, N. J. "Flowrites," comparatively short auxiliary metal tubes which are inserted in the entrance ends of condenser and heat exchanger tubes to prolong the life of the tubes, are also described and illustrated in a new eight page bulletin recently issued.

Commercial Fans

No. 7033—Physical proportions of commercial fans are tabulated in the new fifth edition of form X-12 released by the National Association of Fan Manufacturers, 5-157 General Motors Bldg., Detroit 2. Offered as a service to architects, engineers, and the general public, the tables of fan sizes are said to represent a fair general comparison of the physical proportions of only those fans manufactured by member companies. Tabulated material is arranged in accordance with the Association's standard index system as set forth in NAFM Bulletin 105.

Direct Fired Unit Heater

No. 7034—Lee Engineering Co., 95 River St., Hoboken, N. J., has announced the availability of a new bulletin

These DRILLS are "NATURALS"

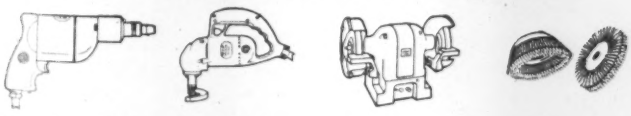
for INTERMITTENT USE!

IF you want a handy odd-job Drill to save time in your shop or on the job, a Black & Decker 1/4" Junior or 1/2" Junior Drill is the tool for you! These Drills are specifically built for shops that need a good low-priced drill for light-duty, intermittent service. They drive twist drills in piping, steel plates, ducts, vents, frames, braces and other metal parts. Drive wood augers for running pipe and duct-work through floors and walls. Drive Hole Saws for cutting clean, round holes in any material a hacksaw will cut. Drive wire wheel brushes and many abrasive attachments. See your nearby Black & Decker Distributor for details. Write for free catalog to: The Black & Decker Mfg. Co., 628 Pennsylvania Ave., Towson 4, Maryland.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS



Electric Screw Drivers | Electric Shears | Bench Grinders | Wire Brushes

Are Insulation Values Permanent?

[READ WHAT AUTHORITIES SAY:]

"Many loose insulations settle down from year to year, producing areas that are eventually without insulation." *"Insulation," by* DALZELL AND MCKINNEY *published by American Technical Society.*

● "Conductivity may vary by several hundred per cent, depending entirely on the arrangement of the fibers."
DR. J. L. FINCK
In Bureau of Standards Research Booklet No. 243.

● "For each grade of fibrous material, a certain optimum density exists. For densities greater and less than this density, the conductivity will increase."
DR. J. L. FINCK
in "Industrial & Engineering Chemistry."

● "Aluminum foil exposed in a vertical position since 1929 to the dust and fumes in the Heat Measurement Laboratory, M.I.T. Samples of this foil have been removed from time to time and the emissivity determined. Over a period of 10 years, no appreciable change in emissivity was found."
PROF. GORDON B. WILKES
of Massachusetts Institute of Technology

Infra is Permanent in Insulation Values

☆ Has lowest conduction—1 part mass to 431 of low-conductive air. ☆

Thermal Factors Stamped on Every Infra Carton

Infra C Factors and Rockwool Equivalents

C.052 Heat Flow Down, equals 6" Rockwool.
C.083 Heat Flow Up, equals 3.97" Rockwool.
C.10 Lateral Heat, equals 3-1/3" Rockwool.

WRITE FOR FREE 32-Page BOOKLET "Simplified Physics of Thermal Insulation."

Architects and engineers use it as a handbook, and colleges as a text, on heat transfer, condensation, vapor, mold, etc. Contains master chart of *k*, C, R and U factors of all insulations, of all thicknesses, weights, densities, etc.

Special section on radiant heating. Address Dept. AC

TRIANGULAR REFLECTIVE AIR CELLS AND ACCORDION ALUMINUM

Infra INSULATION, INC.
10 Murray St., N. Y., N. Y.

VULCAN

NEW TYPE FS FRONT

For new decorative appeal . . . more effective heating

Vulcan's new Type FS Front Cover not only contributes new decorative appeal but also adds new effectiveness to Vulcan Baseboard Radiation, engineered specifically for the utmost in heating comfort, ease of installation and minimum maintenance.

Combining both radiant and convection heat the FS Front provides a more effective radiant heating surface. Convection currents directed *away* from immediate contact with wall surfaces provides better circulation of warm air, preventing high concentration of dust particles where smudging conditions may exist. Entirely new damper feature, installed on request, provides for control of directional flow of convection heat.

For full details on this attractive new Cover for Vulcan Baseboard Radiation, write for supplement to Bulletin #51.

Representatives in principal cities

THE VULCAN RADIATOR COMPANY
26 FRANCIS AVENUE
HARTFORD 6, CONN.
RADIATOR MANUFACTURERS FOR OVER TWO DECADES

on its line of direct fired warm air heaters which may be used in connection with coal, oil, or gas and which feature a counterflow design. Capacities range from 750,000 to 1,500,000 Btu per hr.

Finned Radiation Element

No. 7035—Designed originally for use on locomotive compressed air lines, the "All-Cast" directional finned radiation element offered by Wilson Engineering Corp., 122 S. Michigan Ave., Chicago 3, is described and illustrated in Bulletin No. 40. In addition to describing the characteristics of the elements, the booklet covers numerous applications, such as compressed air radiation for locomotives and stationary compressors, compressor intercoolers, diesel fuel oil heating units, bake oven radiation, and exhaust gas heat recovery. The elements are also used in the company's mobile de-icing and drying machines.

Graphite Pipe and Fittings

No. 7036—An illustrated booklet covering "Karbate" impervious graphite pipe and fittings is now available from National Carbon Co., Inc., 60 E. 42nd St., New York 17. The booklet contains data on the pipe and fittings, including tables of chemical and physical properties. All pipe sizes and fittings are illustrated and cross section drawings show dimensions, assemblies, joining recommendations, and other details.

Industrial Fan Units

No. 7037—DeBothezat Fans Div., American Machine & Metals, Inc., East Moline, Ill., has released three new catalogs on industrial fan units. The 24 page catalog (No. DV-2-48) on axial flow vent sets covers both volume and pressure fans from 16 to 48 in. diameter. "Power-Flow" roof ventilators are covered in Catalog DP-3-48, and Catalog DP-4-48 gives information on the "Bifurcator," a fan wheel mounted in a patented split housing for exhausting corrosive or explosive fumes.

Industrial Use of Direct Fired Air Heaters

No. 7038—Two large "Counterflo" direct fired air heaters are used to bring in and warm approximately 44,000 cfm of outside air at a new assembly plant of Homestead Valve Mfg. Co. The Vol. 3, No. 2 issue of the house organ published by the heater manufacturer, Dravo Corp., Machinery Div., 300 Penn Ave., Pittsburgh 22, includes a description of the installation.

Instruments for Handling Sewage and Industrial Wastes

No. 7039—A 43 page catalog covering instruments for the treatment of sewage and industrial wastes has been compiled by Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Wayne & Roberts Ave., Philadelphia 44. This catalog, No. 7301, covers both applications and instruments. Among the instruments described are electrical and mechanical flow and liquid level meters, pneumatic remote transmission systems, thermometers, pressure gages, "Electronik" recorders and indicators, the "Protectoglo" combustion safeguard, and water circulators.

THERE'S STILL TIME

TO MODERNIZE

YOUR BOILER PLANT

WITH

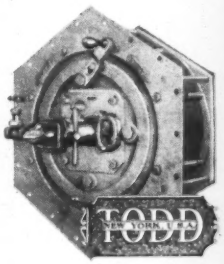
TODD BURNERS

You *can* replace obsolete equipment with Todd Burners and be ready for winter. The capacity of the Todd organization . . . world-wide distributors and facilities . . . standardized equipment . . . are your assurance of economy and efficiency in the burning of liquid and gaseous fuels. Take advantage of the long experience and "know how" of Todd engineers.

Oil Burners

Gas Burners

Combination Oil and Gas Burners

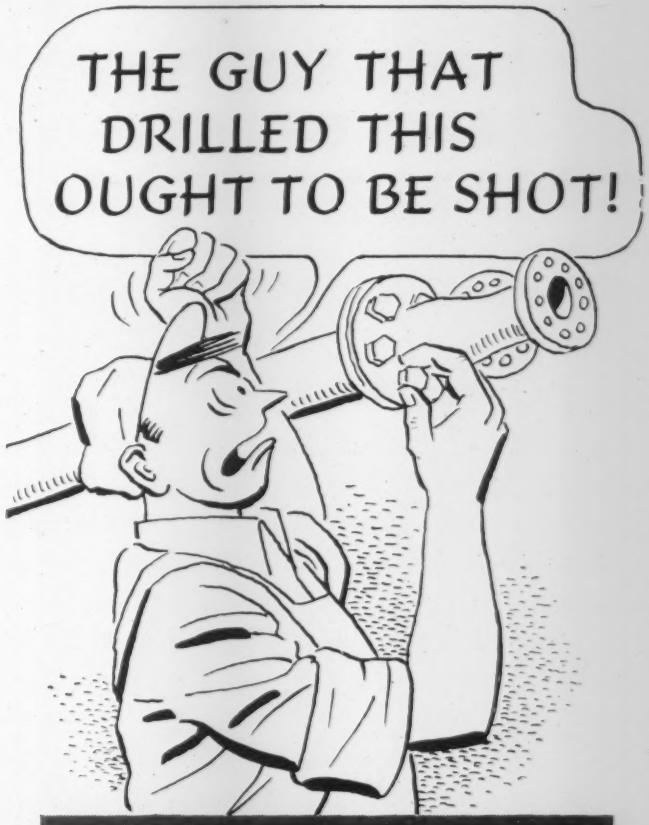


COMBUSTION EQUIPMENT DIVISION

TODD SHIPYARDS CORPORATION

81-16 45th Ave., Elmhurst, Queens, N. Y.

NEW YORK • BROOKLYN • ROCHESTER
BUFFALO • HOBOKEN • NEWARK • PHILADELPHIA
HARRISBURG • YORK • CHICAGO • CHARLESTON, S. C. • BOSTON • SPRINGFIELD, MASS.
BALTIMORE • WASHINGTON • RICHMOND, VA.
ATLANTA • DETROIT • GRAND RAPIDS • TAMPA
GALVESTON • HOUSTON • MOBILE • NEW ORLEANS • LOS ANGELES • SAN FRANCISCO
SEATTLE • MONTREAL • TORONTO
BARRANQUILLA • BUENOS AIRES • LONDON



Holes in "K" flanges are precision drilled on multi-spindle machines

We used to have nightmares about plumbers and steamfitters getting jammed up with misaligned holes in flanged fittings or cockeyed threads in screw fittings.

But now we sleep in peace because we've installed the most modern of precision machinery for drilling and tapping "K" fittings. On top of that, we subject our fittings to the most scientific and most exacting inspection tests.

In short, we produce "K" fittings as if we were going to install them ourselves.

The "K" line of precision-cast, precision-machined, precision-inspected fittings includes:

- Standard and Extra Heavy Cast-Iron Screwed Fittings
- Standard Flanged Cast Fittings
- Standard and Extra Heavy Companion Flanges
- Drainage Fittings

PRECISION FITTINGS

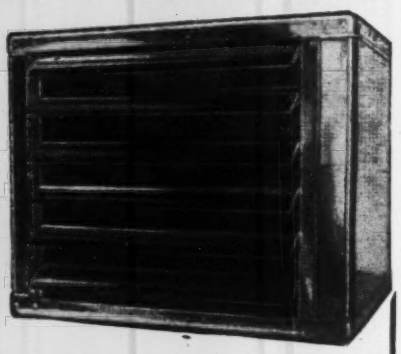
KUHNS BROTHERS CO.

DAYTON 1, OHIO

COMBINED SALES FACILITIES at Malleable Iron Fittings Co., Branford, Conn., and at Kuhns Bros. Co., Dayton, Ohio

KING UNIT HEATERS

TESTED FEATURES *Assure* EFFICIENT LOW COST HEATING *for* INDUSTRIAL PLANTS



Moisture-proof motor, heavy seamless copper coils, copper fins, sturdy KING radiators built for high pressure steam —NO brazed, welded, soldered or bolted seams or joints; direct steam flow for fast heating; special KING-built aluminum fan; quiet rubber-mounted motor—single speed or 2-speed. Easily installed; operated with minimum of attention and upkeep.

Write for illustrated bulletin

THE KING COMPANY

Engineers and Manufacturers

COOLING, VENTILATING, HEATING AND DRYING SYSTEMS

928 No. Cedar St. Owatonna, Minn.

Instruments for Industrial Processing

No. 7040—Technology is the title of a new house or[gan] published by Taylor Instrument Companies, P. O. [Box] 110, Rochester 1, N. Y. According to the company, [the] publication will not only cover the design, develop[ment], application, operation, and maintenance of the fir[m's] products, but will include information dealing with [the] fundamentals of instrumentation, training and org[ani]zation of maintenance personnel, and theoretical [as]pects of instrumentation. The first issue includes [case] histories pertaining to continuous bleaching of paper pulp, a cotton seed oil extraction process, and batch evaporation.

Low Temperature Welding

No. 7041—The Vol. 5, No. 4 issue of the house organ published by Eutectic Welding Alloys Corp., 40 Worth St., New York 13, stresses the company's improved welding alloys available for all torch and arc uses. "Eutectrodes" 24, 185 FC, and 1805 FC are improved alloys respectively designed for cast iron welding without preheat, for numerous types of repair jobs, and for joining copper. Also covered is the new "Cuttrode," in the 3 32 in. size, for cutting thin sheet metal.

Modulating Control for Commercial, Industrial Stokers

No. 7042—A modulating type stoker control system, designed to feed coal and air to the fuel bed to balance

CONTINUOUSLY SERVING THE REFRIGERATION INDUSTRY SINCE 1919

Model DXG—available in a wide variety of sizes and types

Designed to comply with ASME Codes

Dry-Ex Water Chillers

For chilling water in large volume, Acme DRY-EX Water Chillers assure efficient performance. For air conditioning systems and for industrial uses, they have long enjoyed nationwide acceptance.

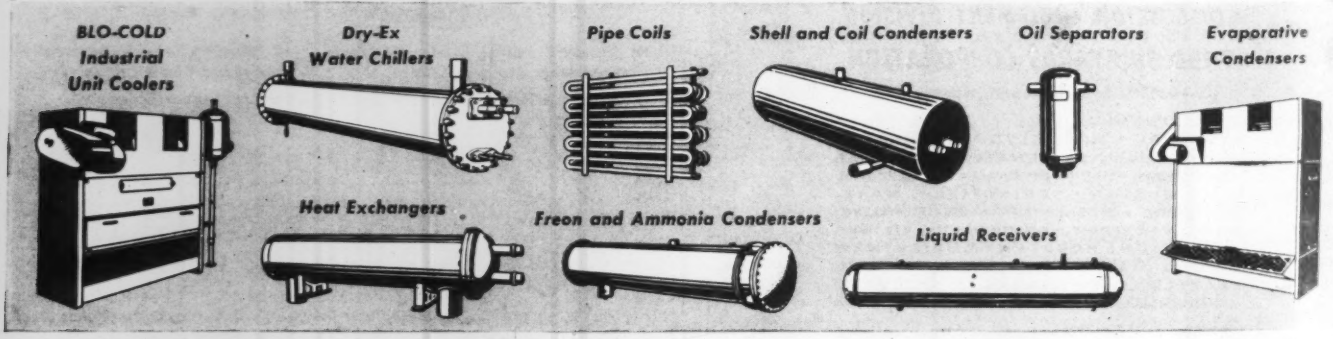
It is easy to select from the Acme Catalog #631 Write for yours today.

ACME PRODUCTS

ACME INDUSTRIES, INC.

Jackson, Michigan

Representatives in Principal Cities



TYPE A PEERLESS PUMPS

TYPE A for

All *purposes.* For widest variety of general services. Handle water and alkaline fluids where no solids are in suspension.

Advanced design. Double suction, single stage, horizontal split case construction. Ball bearing type. Dayton-Dowd design.

All capacities and heads. Sizes: 1¼" to 48". For capacities up to 70,000 g.p.m.; heads up to 300 feet; temperatures up to 250 F.

Ample safety factors. Component parts designed to afford high safety factor in operation and to extend pump life.

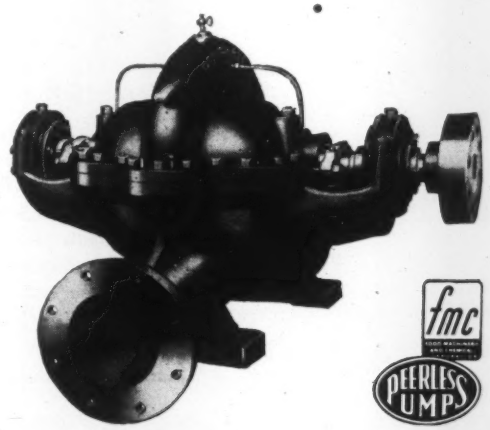
Accuracy in construction. All parts machined to gauge on an interchangeable part system. Rigidly inspected in process.

Augmented service life. Fully tested in Peerless' modern hydraulic laboratory to assure meeting or surpassing customers' application requirements.

For General Purpose Pumping

When there's a pump in your plans, plan with a Peerless Type A General Service pump. Because of the large ranges in size, from 1¼" to 48", the widest range of applications is possible. There is a Type A pump with the capacity rating, head characteristics and type of drive to meet the requirements of most water pumping services in all industries.

Write for Bulletin describing and illustrating the design and the application of Peerless Type A pumps.



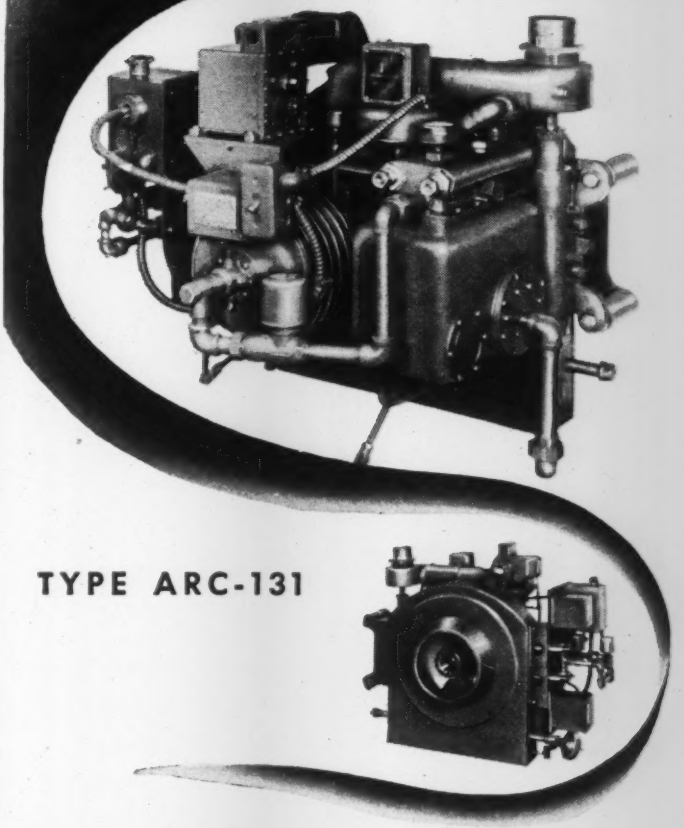
PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

FACTORIES: INDIANAPOLIS, IND.; LOS ANGELES 31, CALIF.

District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 No. Broadway; Atlanta Office: Rutland Building, Decatur, Georgia; Dallas 1, Texas; Fresno, California; Los Angeles 31, California

the RAY *Combination* GAS-OIL BURNER



TYPE ARC-131

Enjoy all the advantages of seasonable low natural *gas* rates with *oil* burning stand-by equipment, *interchangeable in less than five minutes.*

***Burns any grade* of *gas* or heavy *fuel oil* and the operation is *fully automatic* for either fuel.**

Prevention against ignition or flame failure one hundred percent *electronically controlled.*

Developes from *7 to 335 Boiler Hp.* with the choice of direct or belt drive. Other types available, rated from 120 to 1000 Hp.

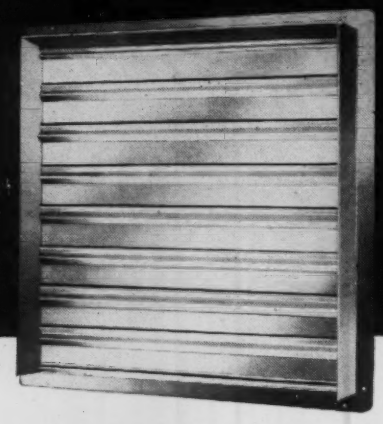
Manufacturers and Combustion Engineers Since 1872

RAY OIL BURNER CO.

401-499 BERNAL AVE., SAN FRANCISCO 12, CALIF.

Distributors in all principal cities of the world

they all want AIR-FLO



MODEL A-555

THE AUTOMATIC SHUTTER WITH ALL THE FEATURES

FRONT VIEW—CLOSED

IT TAKES THE LOAD OFF THE FAN!

Aluminum louvers open fully, permitting capacity fan operation. New heavy reinforcement strip adds strength and long life to the louvers, assures quiet operation and perfect counterbalance, prevents rattling. Deep shroud protects shutter from high winds. Tie-rod, brackets and bearings inside frame, not exposed to weather. Special finish resists corrosion. Many other features.

WRITE FOR NEW AIR-FLO CATALOG 43-D

Illustrations and details of the complete Air-Flo line.

AIR CONDITIONING PRODUCTS CO.
2340 W. LAFAYETTE BLVD. • DETROIT 16, MICH.

the heat input with load demand, is briefly described in a four page folder published by Perfex Corp., Milwaukee 7. Component parts of the system include a series 700 high limit steam pressure control, a series 7100 combustion control, a series 7800 air pressure gage, and a series 6080 actuator.

Motor Brushes

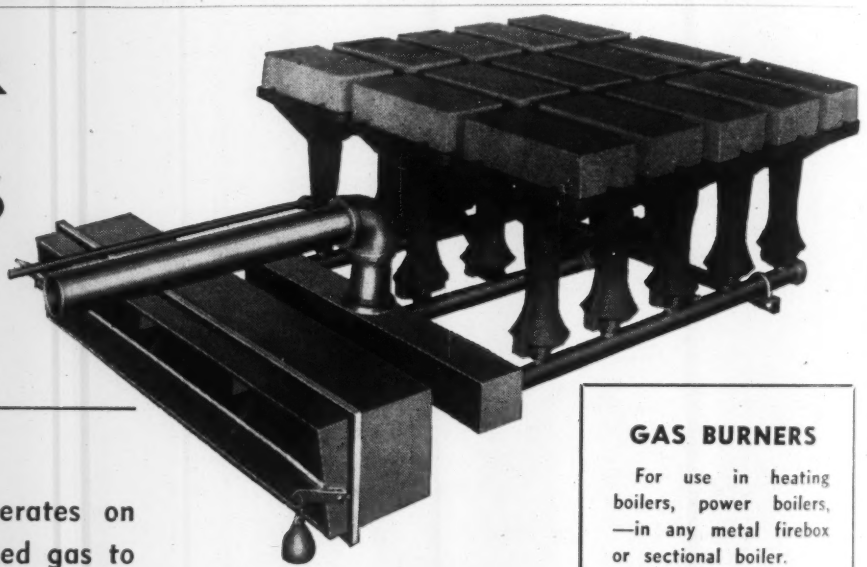
No. 7043—National Carbon Co., Inc., Rm. 1328, 30 E. 42nd St., New York 17, is offering a booklet on its standardization system for carbon, graphite, and metal graphite brushes for motors and generators. The catalog section (No. B-2106) covers the advantages of converting from the use of individually ordered brushes with random specifications to a smaller number having predetermined and unified specifications.

Operations of Pump and Machine Manufacturing Companies

No. 7044—A 16 page booklet, Pictorial Review, illustrates and describes the extensive operations of the three divisions of Hamilton-Thomas Corp., Hamilton, Ohio. These divisions consist of Economy Pumps, Inc., Liberty Planers, Inc., and Klipfel Mfg. Co. The scope of the contract division of Hamilton-Thomas is explained pictorially by covering representative jobs completed in the past year for light and heavy machine manufacturing companies. Scenes of Ohio valley flood control works featuring the use of flood control and drainage pumps, are included, as are other illustrations showing typical operations of centrifugal, axial flow, and mixed flow

WEBSTER
Series F600
GAS BURNERS

50,000 to
10,000,000 Btu.



The Series F600 Burner operates on straight natural gas and mixed gas to 800 Btu. Gives perfect horizontal distribution. Fully automatic controls—that operate properly—can be easily applied.

Write for new illustrated Catalog of Webster Burners and Controls.

GAS BURNERS

For use in heating boilers, power boilers, —in any metal firebox or sectional boiler.

Adaptable to any firebox shape or size.

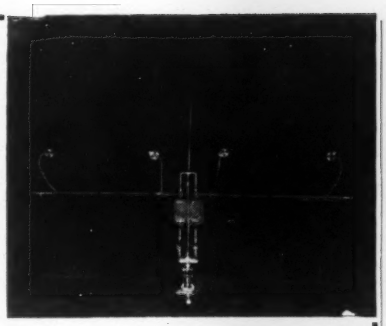
Handles various gas pressures and effects low draft loss.

THE WEBSTER ENGINEERING CO.

— DIVISION OF —

Surface Combustion Corporation . . . . . Toledo, Ohio
TULSA OKLAHOMA

Specialists in Utility Maintenance



RID-AL SERVICE (cleans chemically) steam and water systems. Removing sludge, scale and rust safely and economically.

AKWATROL *conjunctive* scale control *automatically.*

CATALYTIC PROCESS Chemical combustion control increases boiler efficiency—minimizes smoke and soot.

TANK LINING New life to old tanks — completely renewed by our scientific elastic porcelain tank lining.

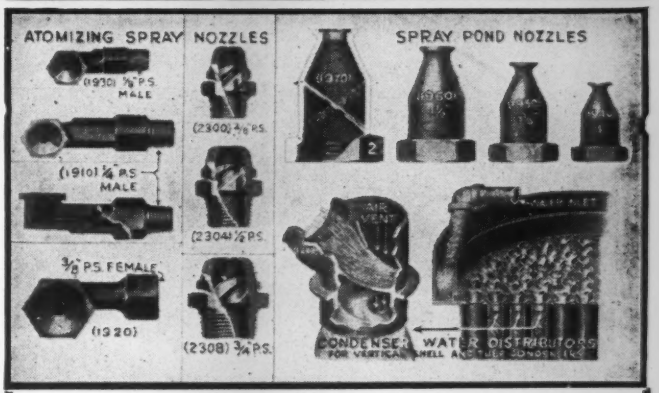
Associated companies render a national service. Your territory may be available.

Write today for literature

APEX Engineering Company

75 E. Wacker Drive, Chicago 1, Ill.

QUALITY always wins! **MARTOCELLO Products are fully DEPENDABLE**



ATOMIZING SPRAY NOZZLES, SPRAY POND NOZZLES, and CONDENSER WATER DISTRIBUTORS

For Vertical Shell and Tube Ammonia Condensers

ALL MARTOCELLO SPRAY NOZZLES are manufactured with precision and of a design which has been thoroughly tested for maximum results and durability. They are guaranteed to give satisfaction. Successful, efficient results depend largely upon selecting the proper number, type and size of Nozzles suitable for your installation.

THE MARTOCELLO CONDENSER WATER DISTRIBUTORS are now used as standard equipment by Progressive Refrigerating Engineers in solving their Manpower problem, because they require no attention and assure users of the lowest Condenser Operating Pressures and Minimum Power Cost. It will pay you to consult us. WRITE or WIRE for further information.

Jos. A. Martocello & Co. 229-231 NORTH 13th STREET PHILADELPHIA 7, PA

"Serving the Ice Industry Since 1916" *"There is no Substitute for* MARTOCELLO QUALITY"

VENTILATING FANS

GB fans ● manufactured for industrial ventilating and heating ● fume extraction ● forced draft ● induced draft ● Air-conditioning ● drying and processing, are of forward or backward curved wheel design.

Type F.C. are designed for quiet operation at low speeds. Type B.C. are designed to operate at high speeds and have the non-overloading characteristics.

Capacities of 200 c.f.m. to 300,000 c.f.m. are covered by standard sizes and arrangements.

The heavier constructions of classes II, III and IV cover the particular needs of special applications.

Send for Bulletin SC-103.

GB

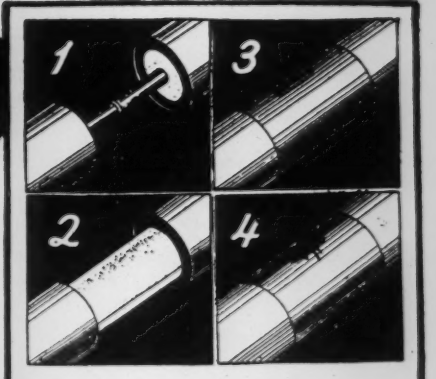
"LUNGS FOR INDUSTRY"

GENERAL BLOWER CO.

8610 Ferris Ave. Morton Grove 15, Ill.

Engineering Offices In All Principal Cities

Positive Protection



4 Simple Steps

1. Field joint ready for inspection. 2. Joint covered with standard pipe insulation. 3. Durant joint casing in place ready for asphalt. 4. Asphalt poured in slot making a perfect seal.

BUILT-IN at FACTORY

For all your underground and exposed piping jobs you'll like DURANT Pre-Sealed Insulated Pipe. It is waterproof . . . reduces installation costs to a minimum . . . eliminates electrolysis and corrosion . . . requires very little trenching and field work . . . avoids extra cost of waste and breakage . . . comes to you ready to install. In short, D.I.P. is the *perfect pipe* for this type of job. Investgate D.I.P.! Write for details today.

SEE OUR EXHIBIT AT NEW YORK POWER SHOW

Ready to Install

PRE SEALED

FOR STEAM HOT WATER REFRIGERATION

Trade Mark

Reg. U.S. Pat. Off.

Durant

INSULATED PIPE CO.

1015 Runnymede St.

Palo Alto, Calif.

D.I.P.

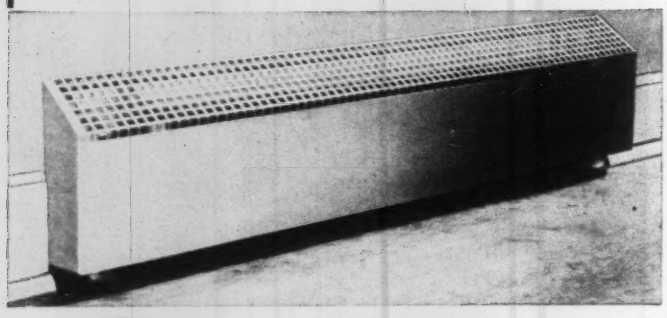
The ORIGINAL Pre-sealed Insulated Pipe

GREATER B.T.U. OUTPUT!

Prompt Delivery

REMPE AIR GUIDE CONVECTORS

Wall panel type



HEAT TRANSFER EQUIPMENT REMPE CO. Founded 1890

FOR INSTALLATION ABOVE OR IN BASEBOARD
FOR STEAM OR HOT WATER

An attractive, easy to install Fin Tube Convector for new installations or replacement of cast iron radiators. Strong slanted steel cover.

Rempe method of using 3/16" collar into which tubes are expanded provides more efficient heat transfer—greater B.T.U. capacity per lineal foot. E.D.R. capacity 4.75 sq. ft. per lineal foot of casing length. 8" high x 3" deep. Lengths up to 116".

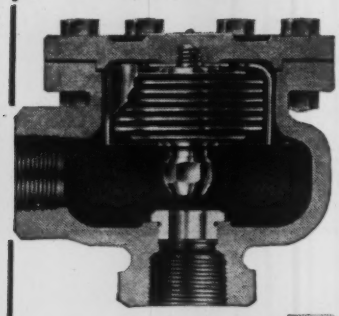
Write today for prices—Territories open.

REMPE CO.
342 N. SACRAMENTO BLVD. CHICAGO 12, ILLINOIS

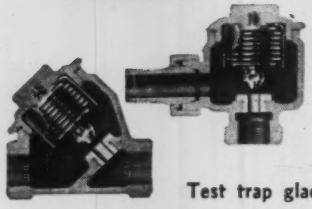
We Invite You

TO TEST NICHOLSON STEAM TRAPS FOR

LOWEST STEAM LOSS
LARGEST CAPACITY



See why an increasing number of America's leading plants are standardizing on Nicholson traps.



Comparative tests by large trap users show: record low for steam waste; 2 to 6 times average drainage capacity; operate on lowest temperature differential; no freeze-ups; greater simplicity (fewer spare parts). 5 types for every purpose; size ¼" to 2"; press. to 225 lbs. Test trap gladly sent. BULLETIN 1047.

W. H. NICHOLSON & CO. 198 OREGON STREET WILKES-BARRE, PA.

Valves • Traps • Steam Specialties

pumps. Also shown are installations of regulating valves and machine tool operations.

Potentiometers

No. 7045—Catalog No. 15-13 on "Electronik" potentiometers has been released by Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Wayne & Roberts Aves., Philadelphia 44. Among the instruments and systems included are strip chart electric control potentiometers, strip chart and circular chart recorders and controllers, precision indicators, indicating controllers, pyrometric switches, and thermocouple and "Radiamatic" assemblies.

Products for Corrosive and High Temperature Service

No. 7046—About 200 standard products for corrosive and high temperature service are listed in a new catalog published by International Nickel Co., Inc., 67 Wall St., New York 5. Checked by manufacturers of each item, this new "Standard Specialties" catalog is said to be the first complete compilation of products which are made of monel, nickel, or inconel and which are available from stock or from standard designs. Among the many items described and illustrated in 47 general classifications are balls, floats, bolts, thermostat parts, thermocouple protection tubes, pipe and pipe fittings, gaskets, valves, cathodes, grease fittings, and vibration isolators.

Protective Coatings for Cold Application

No. 7047—Tar Products Div., Koppers Co., Inc., Pittsburgh 19, has issued a 12 page folder giving details on

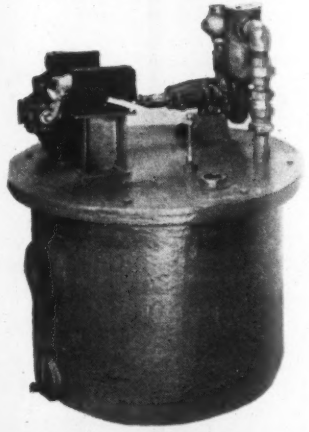
EAGAN . . .

Condensate
Boiler Feed
Vacuum . . .
Turbine
Centrifugal

. . . PUMPS

New Vertical Unit for Underground Installation

Write for Bulletin 12



PUMPS

WALTER H. EAGAN CO.

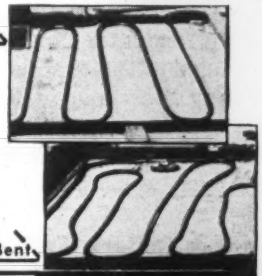
2336-38 FAIRMOUNT AVENUE, PHILADELPHIA, PA.

Announcing

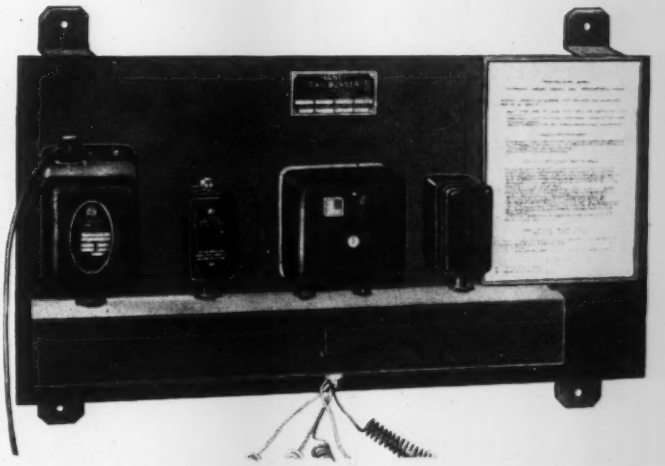
TAL Portable Tube Bender *for radiant heating*

Bend right on the spot, fast and accurately

Now, with this new light-weight machine that can be carried in one hand, you can speed-up radiant heating installations . . . for the Tal Tube Bender handles, without annealing, *hard copper* tubing as well as soft, both K and L, in all diameters from 3/8" to 1" in all standard radii. Changeovers from one size to another can be made in 40 seconds. One man does everything without help. No flattening, no kinks, no wrinkles. Made and guaranteed by Tal, the world's largest exclusive producer of pipe and tube bending equipment. Write today for data bulletin.



Tal Bender, Inc. **Dept. 13** **Milwaukee 2, Wis.**



HANEY ELECTRONIC FLAME FAILURE SAFETY CONTROL PANEL

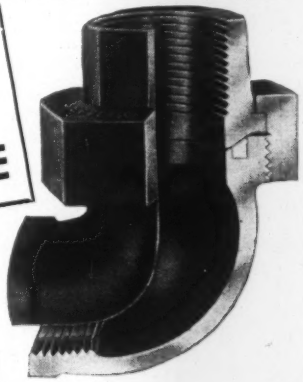
The Haney Electronic flame failure safety control panel, ready for installation, provides safe, sure and positive combustion control and will meet insurance requirements. It is so designed that the burner cannot operate unless a pilot flame of sufficient size to ignite the burner is present and the unit itself is functioning.

Complete, descriptive literature is available and is yours for the asking. Write today.

HANEY GAS BURNER AND ENGINEERS

909 South Myrtle Avenue — Monrovia, California

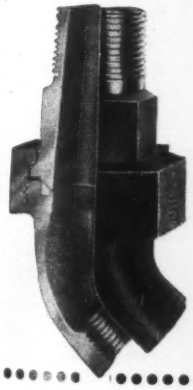
Simplify PIPING MAINTENANCE



with reliable

JEFFERSON UNIONS

An exclusive feature of all Jefferson Unions is the recessed brass seat. It means important savings in the simplification and installation of piping jobs since it goes in easily and if necessary, the joint may be broken time and time again without affecting it's tightly sealing qualities. You can't dislodge it with pipe ends, either. It's in to stay, results in less service interruption and leak-proof joints without undue pressure.



Check with us today . . . we're sure we can show you how to simplify your piping installations.

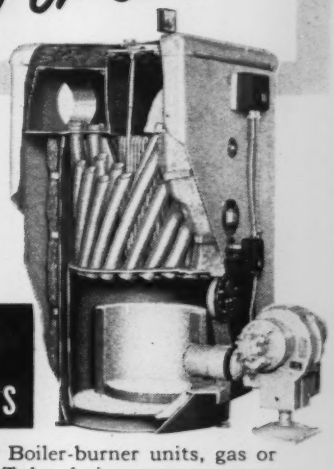
JEFFERSON UNION CO.

607 West 26th Street, New York 1, N. Y.
35 Fletcher Avenue, Lexington 73, Mass.
65 Gooding Street, Lockport, N. Y.

Finer Performance with Oil or Gas

ASME CONSTRUCTION

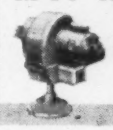
EXCLUSIVE SPIRAL TUBES



Mt Hawley BOILER-BURNER UNITS

104,000 to 1,043,000 BTU Boiler-burner units, gas or oil-fired. Exclusive Spiral Tube design extracts more heat, reduces stack temperature by 100°. 7 sizes—3 domestic; 4 commercial. Shipped assembled, just remove crate. Easy to install. All sizes available galvanized for water heating. Write for literature.

MT. HAWLEY MFG. COMPANY



1, Mt. Hawley Airport, Peoria, Illinois

Manufacturers of a complete line of conversion oil burners—0.65 to 20 G.P.H.

the application of cold-applied protective coatings which are designed to prevent corrosion and deterioration. Data on surface preparation, coating thickness, and methods of application, are included, and the various types of coatings offered are described in detail.

Radiant Heating in Poultry Houses

No. 7048—Benefits available to poultry growers through the use of radiant heating are discussed in a report of a nation-wide survey sponsored by A. M. Byers Co., Clark Bldg., Pittsburgh 22. The report includes a brief description of radiant heating, illustrates typical wrought iron pipe installations, and describes a number of case histories.

Remote Control Uses of Expansible Tube Valve

No. 7049—A new 16 page bulletin (No. 800-B) describes the varied manual and automatic remote control applications of "FlexFlo" expansible tube valves offered by Grove Regulator Co., 65th & Hollis Sts., Oakland 8, Calif. Included in this manual are technical data and diagrams of typical arrangements suitable for stop valves, emerging shutoff and release valves, liquid level control, automatic flow controllers, pump control, slow opening and closing check valves, etc.

Scotch Boilers

No. 7050—The line of Scotch boilers (consisting of 12 sizes ranging in capacities from 10 to 180 hp) offered

These Heaters quickly and economically give needed warmth through positive warm-air circulation. They may be used for Spring and Fall heating or as auxiliary heaters in extreme cold weather. Heaters are easy to install, efficient in service. Air is forced across CHROMALOX Koilstrips by a motor-driven fan and directed by adjustable louvers. Sizes: 1.5-kw to 4-kw, 115-v or 230-v.

GET THE FULL STORY OF ELECTRIC HEAT FOR INDUSTRIAL USE

Send for Catalog 42 and "100 Ways to Apply Electric Heat" booklet which explains the many advantages of using Electric Heat.

EDWIN L. WIEGAND CO., 7610 THOMAS BOULEVARD, PITTSBURGH 8, PA.

CHROMALOX SB-9

ELECTRIC HEATING AT ITS BEST!

STOP COSTLY LEAKS!

SEAL PIPE JOINTS with KEY-TITE

Pipe joints once sealed with Key-Tite do not leak, yet they can be easily opened because Key-Tite does not freeze the connection. It contains no lead nor lead substitutes and does not affect the taste or odor of potable liquids. Key-Tite prevents leaks on all lines carrying water, gas, low-pressure steam, compressed air, etc.

Send for Free Sample — test Key-Tite in your own plant at no cost to you.

KEY Company

2617 McCasland Ave., East St. Louis, Illinois

SB

LETTERS FROM AN OLD FILE

It's interesting to read old letters. We recently ran across a file of testimonials harking back to the time when stokers were usually installed to replace hand firing. Here are some quotations relating to savings effected by Brownell Stokers:

"Reduced coal consumption 20%. Bought coal for $2.00 per ton less. Saved services of helper at $2.50 per day."

"Our four Brownell Stokers are saving 45% of previous boiler operating cost."

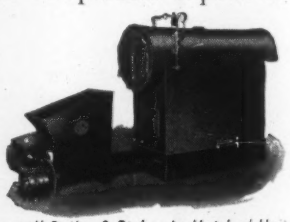
"The cost of our coal purchases has been reduced 50%, and smoke has been eliminated."

"With the Brownell Stoker, one of our steam boilers keeps our building more comfortable than the two boilers did before. Coal bill reduced 35%."

Now-a-days, most Brownell Stokers are installed as original equipment. The owners don't appreciate how much money they're saving, because they never had comparable experience with hand firing.

THE BROWNELL COMPANY

408 N. FINDLAY ST.
DAYTON 1, OHIO



Brownell Boiler & Stoker in Matched Unit

PIPE MENDING CEMENT

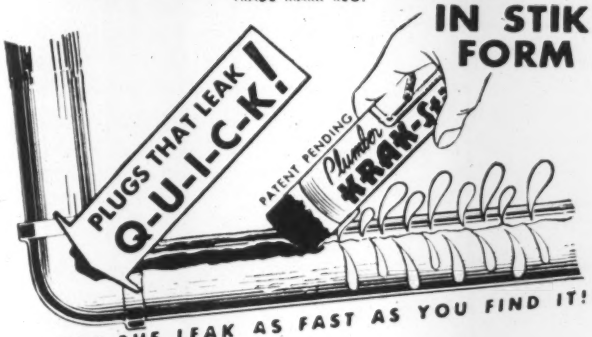
STOPS LEAKS *Instantly!*

Plumber **KRAK-Stik**

TRADE MARK REG.

in Split Soil Pipes, Sand Holes, Cracks — and for Gaskets.

IN STIK FORM



STOPS THE LEAK AS FAST AS YOU FIND IT!

WET OR DRY SURFACES

- A Positive Seal for Water, Acids, Gas, Brine, Etc.
- Just rub "Plumber KRAK-Stik" over the leak—even while water runs thru pipe. That's all!
- Recommended as an excellent Caulking Compound.

WRITE FOR FREE SAMPLE

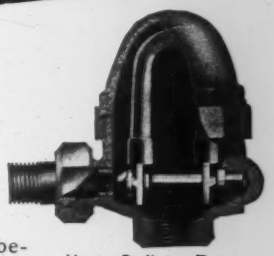
LAKE CHEMICAL COMPANY

612 N. WESTERN AVE. CHICAGO 12, ILL.

HAINES TRAPS

Cannot become air bound

Haines Float and Thermostatic traps are designed to perform efficiently and safely under the most exacting conditions. They're made for low pressure jobs up to 30 lbs. and in sizes ¾" to 1¼".



Vento Radiator Trap

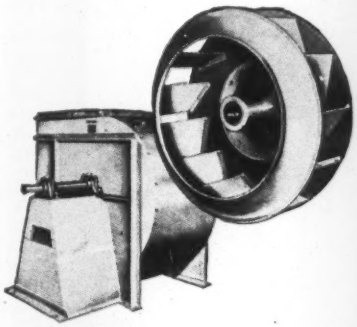
F & T Trap

They cannot become air bound, and the Haines underslung valve principle means safety at all times . . . no danger of building up a pressure. The famous Bourdon Thermostatic tube is used on all Haines traps . . . and is the strongest ever built into a steam trap. You can examine them under pressure, too . . . simply remove the cover and all working parts are before you. Please write now for more information.

WM. S. HAINES & CO.

1012 Wood Street

Philadelphia 7, Penna.



MASSACHUSETTS

POWER FIXED FANS

DESIGN 4

• AIR CONDITIONING • HEATING & VENTILATING • INDUSTRIAL •

Write for Bulletin 101 Catalog

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

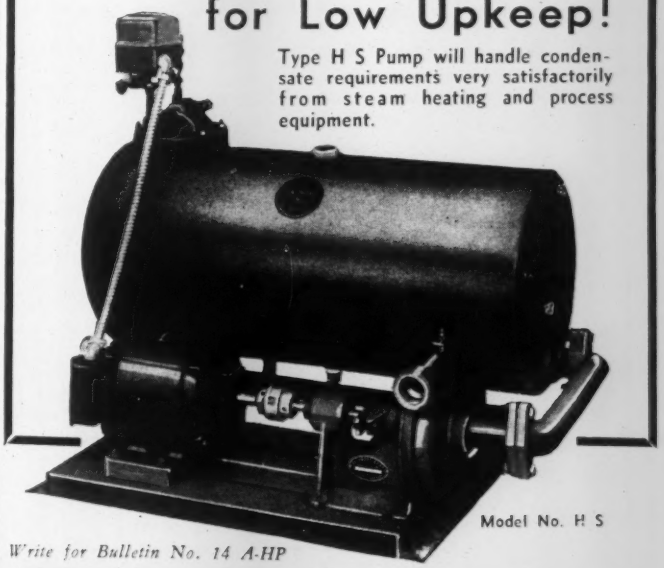
4901 HAMILTON AVENUE · CLEVELAND 14, OHIO

MANUFACTURERS OF QUALITY PUMPS FOR OVER A QUARTER OF A CENTURY

SPECIFY SKIDMORE PUMPS

- - - for Performance! for Low Upkeep!

Type H S Pump will handle condensate requirements very satisfactorily from steam heating and process equipment.



Model No. H S

Write for Bulletin No. 14 A-HP

Skidmore Pumps

ST. JOSEPH, MICHIGAN

Smoke means wasted energy!
SENTRY DRAFT CONTROLS
REDUCE HEAT LOSS . . .
● Sensitive operating action
● Completely automatic operation
● Non-corrosive brass bearings
● Easy to install . . . quickly!
● Factory adjusted for accuracy
● Durable, rugged construction
● Full range of sizes from 6" to 12"
● Fully warranted and guaranteed
● No servicing necessary
● Underwriters' listed
Made by the manufacturers of SENTRY AT-A-GLANCE tank gauges. Write for descriptive literature.
KRUEGER Sentry PRODUCTS
GREEN BAY • WISCONSIN

by Brownell Co., 408 N. Findlay St., Dayton 1, is covered in Bulletin B-8. The manufacturer states that the low construction of these units is a distinct advantage where head room is limited. The boilers are offered for power, heating and processing uses.

Single Control Valve on Water Softeners, Filters

No. 7051—The "Hydromatic" single control valve is now standard equipment on the zeolite softeners and pressure filters offered by Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia 32. Bulletin No. 4460 describes this valve which is said to provide all the normal functions of a valve nest. Power for operation of the valve members is provided by the raw water. Principal features of the valve consist of four normal and two standby positions, the use of pilot actuation, integral rate controls, and flexible bellows.

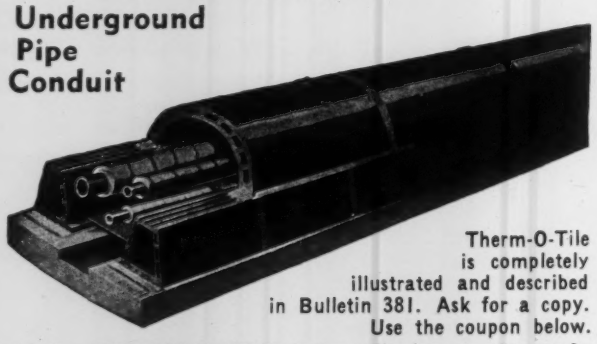
Storage Batteries for Air Conditioning

No. 7052—Gould Storage Battery Corp., Trenton, N. J., has announced a new six page bulletin (No. GB-780) on storage batteries for car lighting and air conditioning. The company's "Kathanode" battery is described and illustrated.

Stud Welding Process

No. 7053—A poster type broadside on the stud welding process of end welding stud-like fasteners to steel surfaces has been announced by Nelson Stud Welding Div.

Ask for data on . . .
THERM-O-TILE
Reg. U. S. Pat. Off.
Underground Pipe Conduit



Therm-O-Tile is completely illustrated and described in Bulletin 381. Ask for a copy. Use the coupon below.

Briefly, THERM-O-TILE is best known as the truly *permanent* underground pipe conduit. Much stronger than required by A.S.T.M. Dry insulation, always. No sagging. No condensation pockets. Highest efficiency. Lowest ultimate cost. Even the *first cost* is competitive.

Sold and installed by Johns-Manville Construction Units in all Principal Cities.

H. W. PORTER & CO., Inc.
822-H Frelinghuysen Ave. Newark 5, N. J.

Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective underground pipe conduit job, on which we shall be glad to have your ☐ comments ☐ quotations.

Name.....
Firm.....
Street.....
City..... State.....

Spraying Systems SPRAY NOZZLES consistently provide accuracy of spray that means better operation and lower cost for you. Whatever you specify in terms of pressure, volume, spray pattern, distribution, impact, and atomization can be duplicated accurately with a Spraying Systems Spray Nozzle. Write for the facts . . . ask for Catalog 22, a reference manual that lists spray characteristics for thousands of spray nozzle types and sizes.

SPRAYING SYSTEMS CO.
Engineers and Manufacturers
4033 W. LAKE STREET • CHICAGO 24, ILLINOIS

WRITE FOR CATALOG 22

NOW ★ PREVENT-REMOVE SCALE and CORROSION

Guaranteed with BECO Patented CELL

Beco-Cell is a proven electrolytic process of reversing the natural attractions that cause scale and corrosion.

Beco-Cell is a Guaranteed self-energizing device with replaceable wearing element.

No Wiring — No Chemicals

On the job since 1940, Beco-Cells have drastically cut shut-down time and equipment losses due to scale and corrosion. Easily installed by your own men — right on the job!

Reduces Costs — Increases Efficiency

Write for information — give us your problem. Inquiries also invited from manufacturers representatives.

★ for —
- Boilers, Gas Engine and Diesel Circulating Systems.
- Hot Water Systems and Generators
- Automobiles and Trucks

Any Heating Appl.

BROWN ELECTRO COMPANY
17 North Dewey ● Oklahoma City 2

ANGLE RINGS

to Specifications

Angle Rings are rolled in our plant every day by experienced, skilled workmen who have the knack of accurately turning out rings with uniform curvature. We can supply complete circles or any part thereof. They can be furnished with or without bolt and rivet holes.

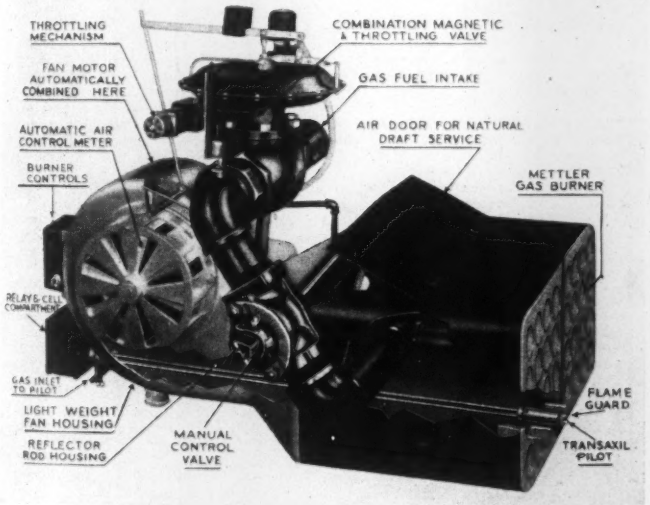
Tees, Bars, Channels and special shapes can also be rolled in the same expert manner to your specifications.

Angle Rings are used for many purposes such as reinforcing tanks, joining pipe or smoke stacks, and installing air conditioning fans. Write for our list of standard sizes and discounts—also our new circular just off the press.

NATIONAL METAL FABRICATORS
2134 S. Sawyer Ave., Chicago 23, Ill.

The Mettler "FAN-AIR" Gas Burner

LATEST MODEL FEATURES NEW AUTOMATIC SAFETY PILOT and TRIPLE CONTROLS



Picture reveals essential and highly desirable POINTS of FAN-AIR MECHANICAL DRAFT GAS BURNERS. Not just a gas burner but a COMPLETE AND FULLY AUTOMATIC BURNER SYSTEM, factory tested and ready for application when received. It comes to you complete as pictured with simple, dependable, automatic controls. No other burner so easy to install. Why be satisfied with less—when all these tangible advantages are so readily available.

Worthy of sponsorship for Scotch Marine Boilers

SIZES 5 to 300 H.P. *PROMPT SHIPMENTS*

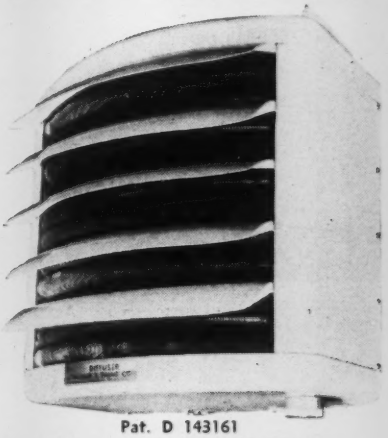
LEE B. METTLER CO.
406 South Main Street
LOS ANGELES 13 CALIFORNIA

M&E EST. 1866

Diffusing Type UNIT HEATERS

Give Wide Angle Diffusion By Rounded Front

60° rounded front creates uniform diffusion of heated air in a 90° arc.



Pat. D 143161

For Low Pressure Steam and Hot Water

7 models available. Handsomely finished in ripple green or white. Simple, sturdy construction—easy to install and simple to service. Widely used and thoroughly proven.

Prices and discounts on request. Territory open for responsible distributors.

Manufactured by

MERCHANT & EVANS CO.
2035 Washington Ave. Philadelphia 46, Penna.